RADIO TO TRANSMIT POWER

POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

REG'D ... MARK, GREAT BRITAIN, No. 410426

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ANNOUNCING AMAZING
TYPEWRITER BARGAIN

BRAND NEW MODEL No. 5
REMINGTON PORTABLE
10¢ A DAY

MONEY BACK GUARANTEE

10 DAY FREE TRIAL OFFER

25% PRICE REDUCTION

● Positively the greatest portable typewriter bargain ever offered! Now for the first time Remington, world-famous manufacturer, offers a NEW purchase plan... only 10¢ a day buys this latest model machine! Not a used or rebuilt typewriter. Not an incomplete machine. A beautiful brand *new* regulation Remington Portable. Standard 4-row keyboard; standard width carriage; margin release on keyboard; back spacer; automatic ribbon reverse; *every essential feature found in standard typewriters!*

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For birthday, Christmas, wedding, anniversary or graduation... give a Remington Portable. The one gift every member of the family will welcome. When Dad brings home work from the office, when Brother has reports to get out, when Sister and Mother answer correspondence . . . a typewriter will do every task faster, neater.

Make Leisure Hours More Fun

A Remington Portable can be carried anywhere and used anywhere. Catch up on correspondence. Write a diary of many experiences. Only a diary will give you a good permanent record of what you have done and what you have seen. You will want a typewriter some day. Get it now!

ACT . . . WHILE LOW PRICE HOLDS GOOD!

New wage scales in our own factories, and in the factories of the companies which make our materials, point definitely to higher prices. Stocks of machines on hand make possible the present unbelievably low cash price on this machine. Everything points to higher prices. We don't believe that we can maintain the present 25% price reduction in the face of constantly rising costs in every one of our departments. So we say . . . "Act fast!"

10 DAY FREE TRIAL OFFER

You can try this machine for 10 days without risking one penny of your money. *Not even shipping charges.* Send for complete details on this most liberal offer. Get attractive new catalogue illustrating and describing the many Remington models available on unusually low terms. Clip coupon today!

EVERY ESSENTIAL FEATURE found in Standard Machines

Buying a typewriter isn't like buying a suit of clothes. Many Remington portables, seeing 10 years of hard service are still in active use. When you buy...buy a machine with every *standard* feature. The Remington No. 5 is the most compact and durable portable ever built...includes all essential standard typewriter features. This beautiful machine represents the height of economy . . . unequalled economy in first cost . . . unequalled economy in service.

It is today the best value ever offered in typewriter history . . . and that statement comes from the company that has constantly *made* typewriter history. Buy now. It is a real bargain offer.

Specifications . . .

The Model 5 includes every essential feature found in standard typewriters. It has standard 4-row keyboard, Complete visibility. Standard width carriage for long envelopes. Carriage return lever of exceptional design for easy and rapid operation. Margin release on the keyboard. Automatic ribbon reverse. Back spacer. Two color ribbon shift. Variable line spacer. Adjustable margin stops. Auto set Paragraph Key (one of the most useful features found on any typewriter). Weight 11 lbs. 13 oz. Furnished with Pica or Elite type.

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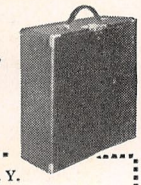
When you get your new Remington No. 5, you will get with it . . . ABSOLUTELY FREE . . . a 19-page course in typing. It teaches the Touch System, speeds up work. It is simply written and well illustrated. Instructions are easy as A.B.C. Even a child can understand this method. A little study and the average person, child or grown-up, becomes fascinated. Follow this course during the 10-DAY FREE TRIAL OFFER that we give you on your typewriter. At the end of that time, you should be able to dash off letters faster than with pen and ink.

CARRYING CASE — FREE



With every Remington No. 5, a FREE carrying case sturdily built of 3-ply wood. Covered with heavy DuPont fabric. Top is removed in one motion, leaving machine firmly attached to base. Can be used anywhere . . . on knees, in chairs, on trains.

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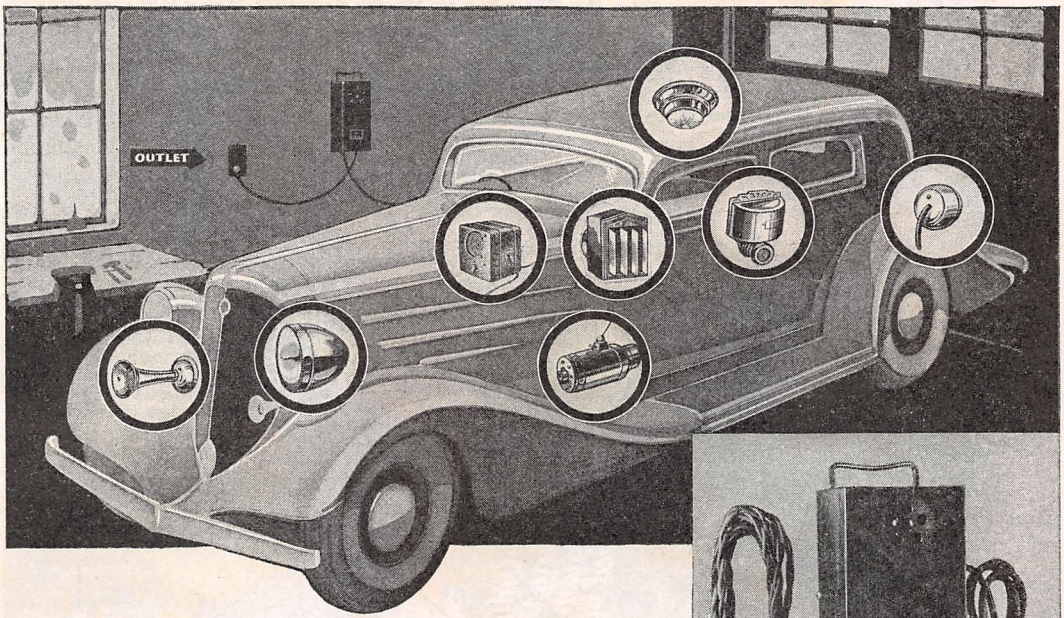

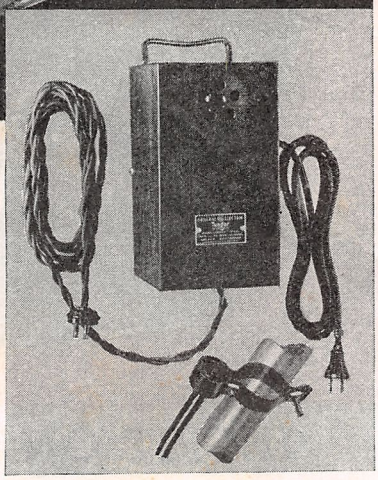

$12.95 BUYS THIS COMPLETE HOME BATTERY CHARGER

(Prices slightly higher West of Rockies)

Look at all the electrical accessories on your car . . . headlights, horns, heater, radio, dome and dash lights, cigar lighter, tail-lights, etc. All of them contribute to your safety and pleasure while driving. Yet they all are made possible by the storage battery which furnishes the necessary power. Don't sacrifice these comforts merely because they discharge your battery.

The New Tungar Home Charger guarantees a fully charged battery at all times. It delivers a full 5-ampere charge. Like any appliance, you simply plug it into any A-c. electric outlet. No messy floorboards to handle. Wiring accessories furnished permit easy connection of Charger to battery through special outlet on steering post. For a few cents, the 5-amp. Tungar operates safely all night. Batteries are protected from over-charging and power failure. The 5-amp. Tungar prevents run-down battery troubles before they start. It assures proper operation of all the electrical accessories on your car. See your dealer or mail the coupon today for complete information.

Section A-8211, Merchandise Dept., General Electric Company, Bridgeport, Conn.

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Name.....

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City.....

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radio's big stars urge you . . .

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and you are sure of getting genuine Micro-Sensitive RCA Radio Tubes

LOOK FOR THIS SIGN in your neighborhood. It identifies a dealer selected by RCA to serve your radio tube needs.

DON'T be fooled by old worn-out radio tubes palmed off on the public as new. Ask for genuine RCA Radio Tubes that come to you in a sealed, non-refillable carton. They can be tested without removing the carton . . . but the carton *must be destroyed* before tube can be used.

To increase your radio pleasure, ask your nearest authorized RCA Radio Tube Agent for the new Micro-Sensitive RCA Radio Tubes.

These are the tubes guaranteed by the RCA Radiotron Company to give you these five big improvements: *(1) Quicker Start. (2) Quieter Operation. (3) Uniform Volume. (4) Uniform Performance. (5) Sealed Carton Protection.*

BE CAREFUL

Hundreds of thousands of used radio tubes are being sold as new by dishonest dealers — slipped into new open-flap cartons — so you can't tell the difference.

TUNE IN on Radio City Studio Party 9 to 9:30, E.S.T., every Saturday night over N. B. C. Blue network . . . Stars of favorite programs.

RCA Cunningham Radiotron RADIO TUBES

Popular Mechanics Magazine

H. H. WINDSOR, Founder H. H. WINDSOR, Jr., Editor and Publisher

November, 1934 Vol. 62, No. 5

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In the Land of Make Believe

NOTHING is impossible in the movies. Hollywood can turn out a picture showing actors strolling the Paris boulevards although these people may never have set foot in France. Hollywood can produce a scene depicting a hungry lion chasing a frightened monkey although the animals may never have seen each other in the flesh. Clever and ingenious tricks which defy deception have been developed by the movie industry in making the "impossible" shots you see almost daily on the screen. In the December issue are eight pages in color depicting unusual movie scenes and an article describing how they are made.

Next Month

MECHANICAL brains are coming to the aid of medical science in its ceaseless war on disease. Chattering tabulating machines have revealed the types of children most susceptible to infantile paralysis and mathematics has shown that people pass through a cycle during which they are alternately more and less susceptible to common colds. Read next month how epidemics and plagues are being fought today.

The Super-Power Age

A LITTLE more than fifty years ago, Thomas A. Edison began selling electric current to fifty-nine customers. Today, through the miracle wrought by the transformer and alternating current, we have vast power units like Niagara Falls and Boulder Dam. In the next issue is an article telling how high-voltage electrical transmission has created new wealth and new industries with even larger projects contemplated.

Want a Home?

IF you want to build a home or repair one you already own, Uncle Sam is willing to aid you. He is now helping to finance home owners in modernizing their property and soon will be ready to aid the man who wants to build. Read in the December issue how the government will help you build your own home.

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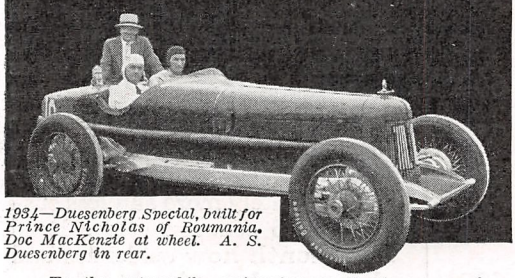
A.S. DUESENBERG

GENIUS OF AUTO ENGINEERING

Depends on

PYROIL



1934—Duesenberg Special, built for Prince Nicholas of Roumania. Doc MacKenzie at wheel. A. S. Duesenberg in rear.

To the automobile engineering world, the name of Duesenberg stands for genius and authority. Recently, Mr. A. S. Duesenberg built his latest and finest race car, shown above, on special order for Prince Nicholas of Roumania. Here's what Mr. Duesenberg has to say:

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(Signed) A. S. DUESENBERG

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Please send me important facts of Pyroil's economy and efficiency when used in my motor. Also, send *Trial Test Offer.*

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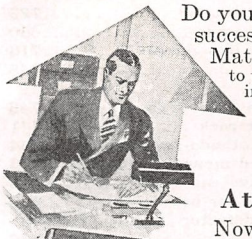
Follow the Direct Road to Success



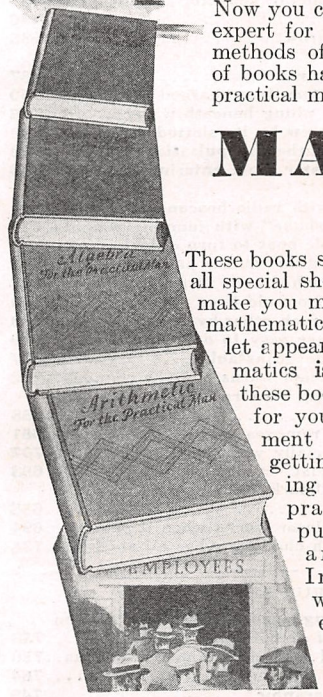
Do you want a better position and a larger pay envelope? There is just one way to win success—be head and shoulders above your fellows by gaining a broader basic education. Mathematics is the basis of all education. Not a day passes in which you do not have to use mathematics in your work. Do you make your own calculations, or are you handicapped by your inability to do this work yourself? Here is the whole secret of success. This is why mathematics is taught in every school and college. A thorough knowledge of it makes clear so many things which are puzzling you today. Do not let another day pass without doing something to improve your knowledge of mathematics. But how can you obtain this knowledge? By going back to school or college, or taking an expensive correspondence course? You need do neither!

At Last! Mathematics Self-Taught This Simple, Easy Way!

Now you can take advantage of this easy method which has been worked out by an expert for those who do not wish to give the time and money required by other methods of mathematical study. A very simple and extremely interesting group of books has been prepared for you by a man who has devoted his life to teaching practical men the fundamentals of this important subject.

MATHEMATICS FOR SELF-STUDY

By J.E. Thompson, B.S. in E.E., A.M.
Dept. of Mathematics, Pratt Institute, Brooklyn



These books start right from the beginning with a review of arithmetic that gives you all special short-cuts and trick problems that save countless hours of your time and make you more valuable to yourself and your job. Then they go right into higher mathematics and show you how simple it is when an expert explains it for you. Don't let appearances fool you, mathematics is *easy*. You can get these books on approval and see for yourself how much enjoyment you can have while getting this valuable training and solving interesting practical problems that puzzle your friends and fellow-workers. In no time at all you will be tackling with ease the most difficult question on this subject.

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Trigonometry for the Practical Man
Calculus for the Practical Man
4 Volumes—1240 Pages—Illustrated

An Expert Gives You These Simplified Methods

Mr. Thompson, the author of these books, is not an ordinary teacher of mathematics. He has had many years' experience in giving students the kind of mathematical training they need in practical work. He presents each practical method and problem in the clearest and simplest way. He gets right down to the kind of information that you need in your daily work. Look up any mathematical problem that puzzles you in these books and see how quickly you get the solution.

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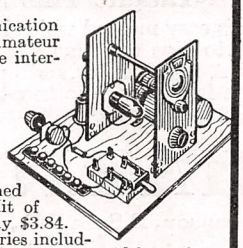
BUILD RADIO

NEW-INEXPENSIVE TWO-WAY 5 METER PHONE for BEGINNERS



5 Meter Phone Communication opens a thrilling new Amateur radio field. Thousands are interested. Newcomers and experimenters particularly will find the 5 Meter Phone Band full of fascination. You can build your own Amateur 5 Meter Two-Way Phone at an amazingly low cost. Designed by Jones and Marsh. Kit of essential parts sells at only $3.84. Kit complete with accessories including hand microphone, type '19 tube, and batteries, is only $9.69. Simple to build. With complete blueprint. Equally successful as transmitter and receiver.

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MONEY—$ $ $—what will YOU do for it?

Have you—like most men—said to yourself at one time or another—
"I'd do almost anything for money"?
And did you really mean what you said—are you ready to back word with action?
If so—read on. If not—turn the page.

IF you want something out of life, you've got to pay for it—in one way or another.

Money—business success—prestige—position—these things don't come for a wish—you have to pay for them.

To earn more—you must learn more—know more—be able to do more.

Your spare time—spent in training—under the LaSalle Problem Method—is a short cut to this larger ability.

But even this short cut requires its price—calls for initiative, ambition, extra effort. Consequently, the many pass it by—continue vainly to hope for luck or pull or "something" to bring their desired success.

But the few who are really in earnest—and there have been more than three-quarters of a million of them in the twenty-four years of LaSalle's history—find in LaSalle training their pathway to promotion, to a business of their own, to prestige, to money.

Take, just for example, these four cases:

IN 1924, a Bookkeeper—IN 1927, Vice-President

Mr. A——— of Indiana was marking time in a bookkeeper's job back in 1924—after a fine war service and various attempts to find himself in farming, in managing a truck line, and in other jobs. With his enrollment in LaSalle came the change upward.

First he became office manager of a cannery firm, then entered the automobile field, and in 1927 became vice-president of one of the large automobile sales agencies of the Middle West. He says, "Spare time invested in study with LaSalle pays compound interest."

GETS the Last Laugh!

"Mr. C. P. A."—that's what the boys at the bank jokingly called Fred Williams when he enrolled with LaSalle. The idea of a 21-year-old trying to learn—*by home study*—a branch of business as specialized and highly paid as Higher Accounting!

But Williams got the last laugh. Not only did he pass the C. P. A. examination—but today, just nine years later—he is head of his own Chattanooga firm, and clearing—on the average—$9,000 a year. The men who once laughed at his ambition are coming to him for jobs.

Mr. Williams writes: "Your representative told me when I enrolled that I would receive $50 for each hour of study, but *I have far exceeded that figure a number of times.*"

CLIMBS Out of 20-Year Rut—

The future looked bright when Arthur Griffin—"just a kid"—went to work as a railroad clerk twenty years ago. A year passed—then another—and another—and, to his horror—he gradually realized that he was caught in a rut, with his best years almost gone. Perhaps *you* know how helpless he felt.

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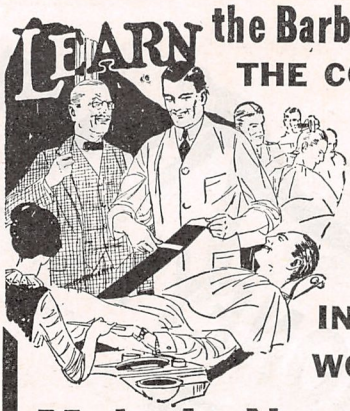

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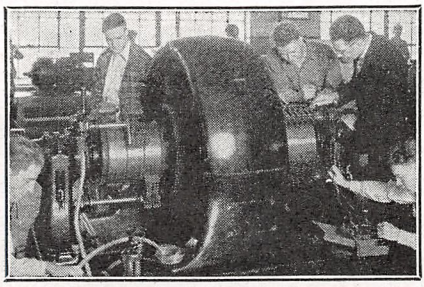

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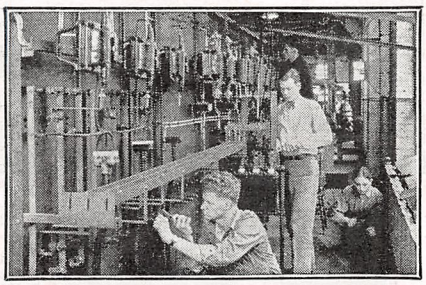

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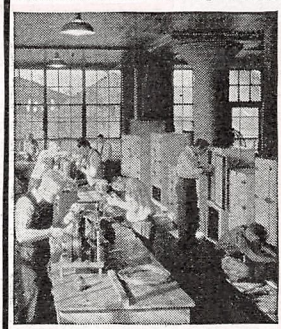

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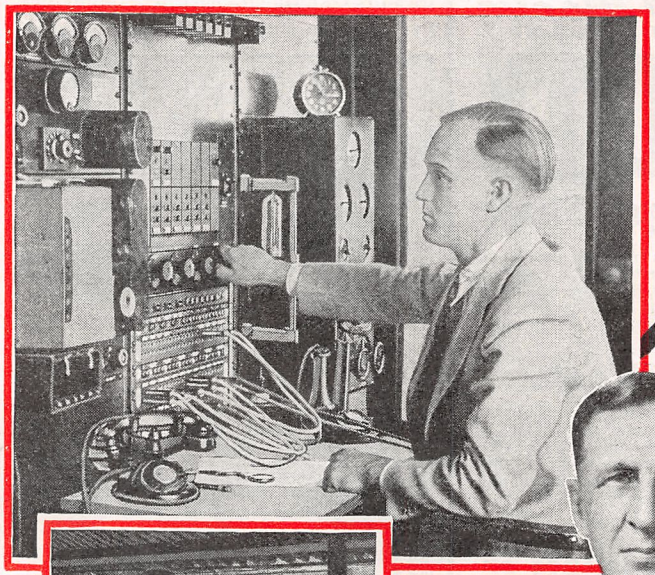

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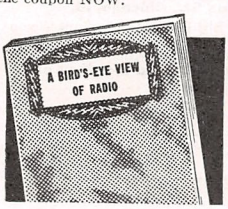

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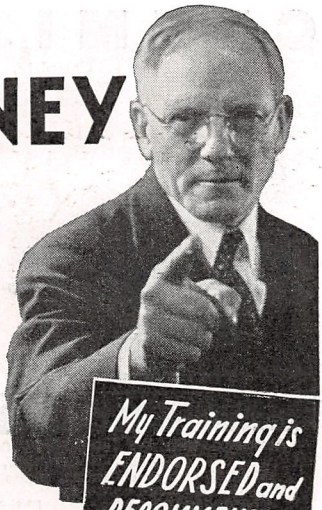

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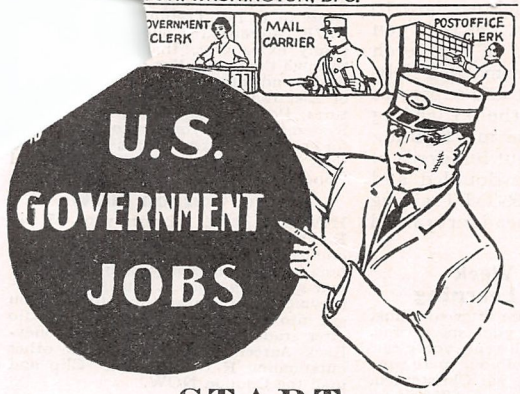

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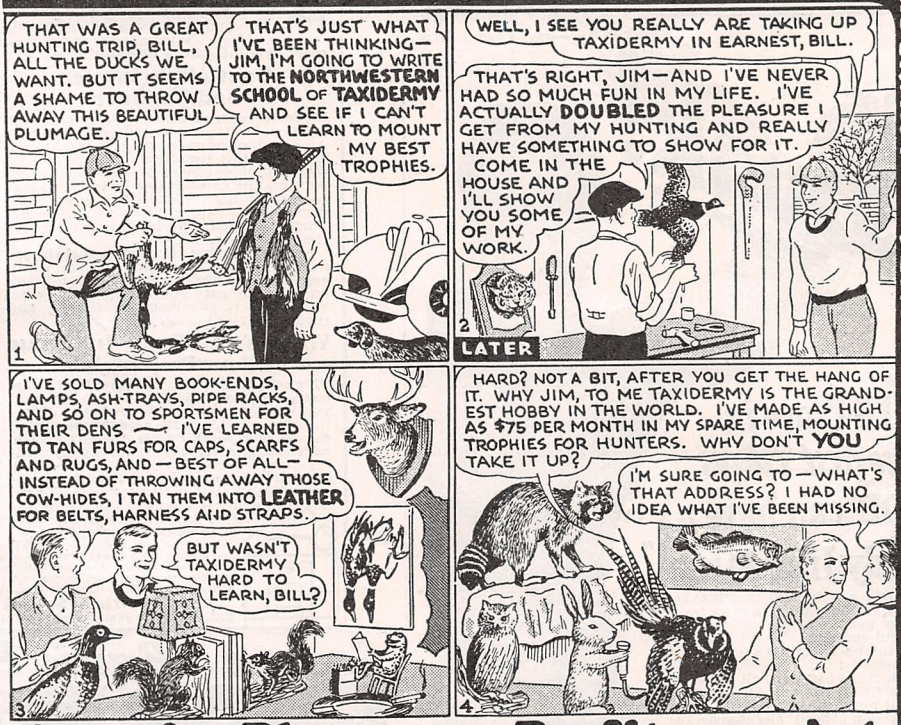

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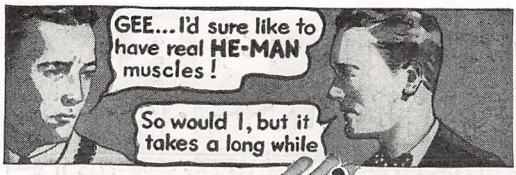

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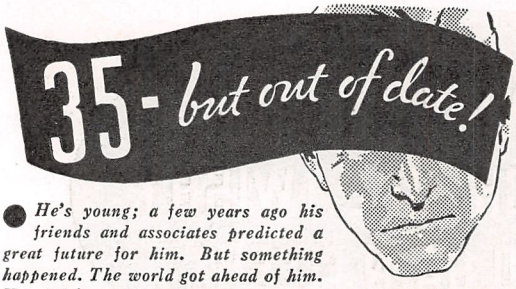

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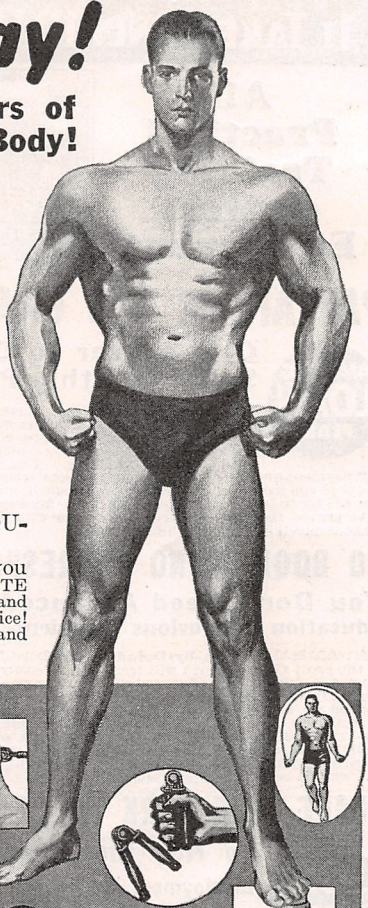

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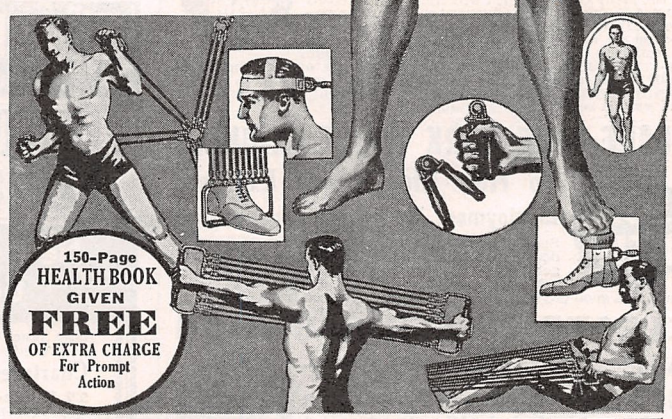

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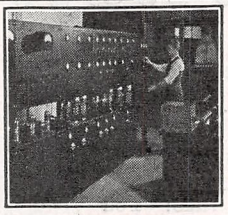

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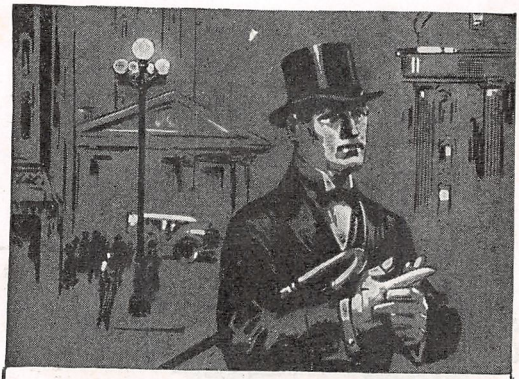

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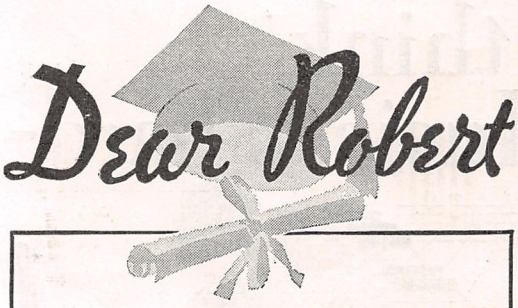

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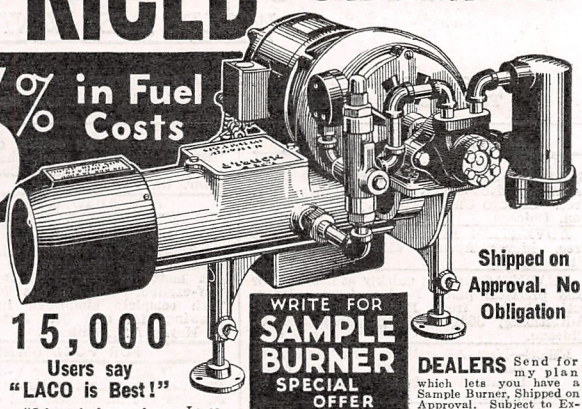

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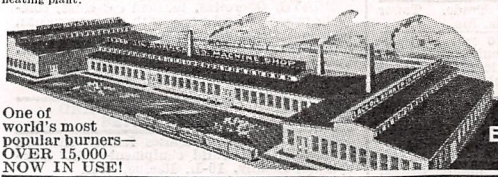

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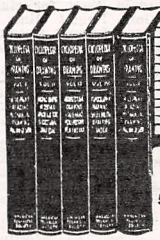

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8. WHAT Is a "Record of Invention" form? See page 43A.

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5. HOW Many years does a mechanical patent remain in force? See page 43A.

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6. HOW Does the issuance of a patent protect the inventor? See page 43A.

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ROLLS Developed. Two beautiful double-weight professional enlargements and 8 guaranteed Never Fade Perfect Tone prints. 25c coin. Rays Photo Service, LaCrosse, Wisconsin.

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16MM FEATURES Rented anywhere $5.00. Shorts dollar reel. Lists. Thousand feet 35mm $1.00. Remington Pictures, Cincinnati.

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OLD Spark plugs worth 3c each. Thousands being rebuilt. Start profitable route. Collecting, selling, shipping, instructions 25c. Hammond Sales, Paulding, Ohio.

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DIME Brings 500 money makers. Bruce, 1315 E. 63, Chicago.

SCREW-HOLDING Screw drivers! Not magnetic! Remove, hold, insert screws in accessible places. Factories, garages, electricians, mechanics, radio, autoists buy; no competition! Quick sales, big profits. Exclusive territories; also foreign. Toolco, 5059 Winthrop Bldg., Boston, Mass.

SELL Common [illegible] lb. Complete [illegible] (coin). [illegible]cott, Clyde, [illegible].

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NEW Money-Making plan for stamp. Hurry. George Talbot, Norwood, Mass.

TWELVE New successful money-makers. J. Home, 3949 Metropolitan, Chicago.

LIQUID Marble—Anyone can make! Colorful, glazed! Molded, brushed, sprayed. Rubberlastic molds. Composition flooring. Big money making these! Particulars free. Marbleizing Service, Edwardsville, Ill.

FREE Circulars describing how you can make real, big money in mail order business at your home. Write today, Dept. 8, Mail Order Institute, 669 Marcy Avenue, Brooklyn, N. Y.

100 PROFITABLE Mail order and local business plans. A. Pruitt, Elburn, Ill.

WIN Thousands cash! Send 10c, list, legitimate contests. World Contests Magazine, 6823A - 17th N. E., Seattle.

SUCCEED With your products. Learn how. Formulas. Processes. Analytical service. Catalog free. B. Thaxly Co., Washington, D. C.

HANDY Men—Establish vacuum cleaner repair service. Big profits. Write National Distributing Co., Box 32, Washington, D. C.

CHEMICAL Expert will furnish formulas and trade secrets. All lines. Lists free. W. L. Cummings, Ph. D., 228 Gordon Ave., Syracuse, N. Y.

START Little business anywhere. Everything furnished. No canvassing. Maywood, PM.923 Broadway, New York.

MAKE Big money molding novelties. Sample mold 25c. Write for details on free course in mold making. Stewart's Studio, B2102 West 19th, Chicago.

MANUFACTURING And retail business. Suited for a man and woman or two women. Excellent profits, big sales. No chain competition. Easy to learn. Hardly any capital. Free literature. Success Associates, Box 852, Syracuse, N. Y.

START Your mail order business right. There are certain essentials—Promotion methods indispensable in selling successfully by mail. Without them you can't make a profit. Using them means establishing and maintaining a paying business. Send only one dollar or free literature for purple stamp. Teghman, 2861 W. Grand Blvd., Detroit, Michigan.

SELL By mail. Books, novelties. Bargains! Big profits. Particulars free. B. Elfco, 525 S. Dearborn, Chicago.

CASH Income daily resilvering mirrors at home. Replating autoparts, tableware, etc. Outfit furnished. Write Sprinkle, Plater, 127, Marion, Ind.

BIG Money at home plating auto parts, reflectors, mirrors, chandeliers; by new method; experience unnecessary. Outfits furnished. Gunmetal Co., Ave. N, Decatur, Ill.

FREE Booklet describes 87 plans for making $20-$100 weekly, in home or office, business of your own. Elite Co., 214 Grand St., New York.

ARTIFICIAL Marble sanitary flooring, instructions covering wood or cement flooring ½ inch thick, fireproof, all colors, low cost. Ornamental casting, concrete plaster papier-mache decorations, garden furniture, statuary, flexible molds, particulars and illustrations free. Chris. Mahler, Elmont, N. Y.

MAKE Products yourself. Tested formulas—catalog free. Grinstead Laboratory, Edwardsville, Ill.

MAIL Order business is your opportunity. Many began small, now earn thousands yearly. No personal contact. Boundless opportunities. Have had over 30 years experience; will help you succeed. Send 25c for valuable booklets, none free. B. Breniser, 257 South 21st, Philadelphia.

FORMULAS AND TRADE SECRETS

MULTIGRAPH Ribbon rejuvenator, formula $1.00. Many other guaranteed formulas. Profits tremendous. List free. Thermo, Peoria, Ill.

MODERN Beauty products, 10 formulas 50c. Clenco, Postal Box 17, Verdun, Que., Canada.

5 GASOLINE Intensifying and decarbonizing formulas—$3.00! Manufacturing formulas supplied! T-S-G Co., P. Box Ten, Wilkinsburg, Pa.

500 FORMULAS 25c; Moneymaking literature free. "Ideal," 178P, Parkridge, Ill.

FORMULAS—32 Different solders 50c. G. Pennington, R1, Robbinsdale, Minn.

SPECIAL Formulas not listed elsewhere from Chemist, 830 South 41st Street, Omaha, Nebraska.

FORMULAE And processes developed for making automobile anti-freeze, stopleaks, synthetic resin polishes, etc. Chemical Research Laboratories, Ossining, N. Y.

ANY Formula 50c guaranteed. McAlea, 1619 Mediterranean, Atlantic City, N. J.

ANY Formula you desire 25c (coin). Westcott, Clyde, N. Y.

CHEMICAL Coal saver; latest economical formula, 25c. Duffy, Covington, Ky.

10. WHEN Can an article be marked "Patent Applied For"? See page 43A.

25 LATEST Beauty, polish, soap formulas, source of supply, only $1.00. Big profits. Olender Co., 1228 Park Row Bldg., New York.

3,000 FORMULAS, Facts, processes, trade secrets in Dr. Brown's Book of Formulas—380 pages. Price, postpaid $1.00. Ogilvie Publishing Co., 57 Rose Street, Dept. 25, New York.

FORMULAS, Plans, ideas. Literature free. Belfort, 4042 N. Keeler, Chicago.

MANUFACTURERS' Service, Box 628, Central Station, St. Louis, Missouri, furnishes formulas successful manufacturers use. Particulars free.

500 MONEY Making formulas 25c. Descriptive circulars free. Harvey Teeple, Decatur, Ind.

NEWEST Guaranteed formulas. Catalogue free. Special prices, leads. Gibson, Chemist, B D 4702 N. Racine, Chicago.

GUARANTEED Formulas, best science can produce for making popular, biggest-selling specialties all lines. Don't buy formulas till you've received valuable eye-opening literature. Miller, Chemist, 706-F Jetton, Tampa, Fla.

SUCCEED With your product. Learn how. Formulas. Processes. Analytical Service. Catalog free. B. Thaxly Co., Washington, D. C.

FORMULAS, All kinds. Guaranteed. Catalog free. Kemico, 31, Parkridge, Ill.

TESTED Formulas—Newest, guaranteed! Catalog free. Grinstead Laboratory, Edwardsville, Ill.

ART NOVELTIES

MAKE Big money molding novelties. Details free. Sample mold 25c. Write today. Stewart's Studio, P2102 W. 19th, Chicago.

CHEMISTRY

HANDBOOK For chemical experimenters (revised 1934) illustrated, 50c. Experiment booklet 15c. Catalogue 10c. Reading Scientific Co., Reading, Penna.

ANYTHING Analyzed. Practical formulas. Write, Associated Chemists, Indianapolis, Ind.

AMATEUR Chemist magazine—3 months 25c. 1017 High, Petersburg, Va.

CHEMICALS, Laboratory glassware and apparatus. Catalog CP. Biological Supply Co., 1176 Mt. Hope Ave., Rochester, N. Y.

CHEMISTRY Magazine. Hundred experiments. Sample 15c. Brownlea, 218 Henry, New York.

CHEMISTS' Slide rule, editorial Jan. issue, saves time solving equations, gives molecular weights, shows formulas, 391 compounds. Durable precision instrument. Postpaid, complete instructions, two dollars. MWC Company, 508 Andrus Bldg., Minneapolis, Minn.

FREE! "Sciencecraft" Magazine and other scientific literature. See page 27A.

SEND 10c For new catalog listing chemical, microscope and photographic kits and supplies. Special 30 day offer to those who send immediately. Winn Company, 124C West 23 Street, New York.

SCIENCE

TRUE Scientific solution of the bewildering problem of: "What would be the result if an irresistible force collided with an immovable body." Enclose one dollar bill for your copy of this esoteric analysis. Carroll Spencer, 7214 Quick, River Forest, Ill.

AGENTS WANTED

AGENTS—Specialty salesmen—Demonstrators—with automobiles preferred. America's latest patent development for auto owners. Subtyre eliminates flat tire worries forever. No jacking of car necessary. Device which thousands of autoists buy on demonstration. Your profit $5 on every sale. Send now for exclusive territories and full descriptive details. Wolf Specialty Co., Dept. P, 85 E. Hawthorne Ave., Valley Stream, L. I., N. Y.

MEXICAN Feather pictures Christmas novelty. Send 25c (stamps) for $1.00 worth sample and details. Mexican Art, Apartado 1593, Mexico, City.

PROFIT With new products. Make, sell, repeat. Guaranteed formulas. Special prices, leads. Biggest catalog free. Gibson, Chemist, BD-4702 North Racine, Chicago.

SEND Hose size for samples and opportunity for $20 week job. Just show sensational guaranteed hosiery to friends. Dignified pleasant easy work. Everything supplied Wilknit Hosiery, Desk 3711, Greenfield, O.

LARGE, Steady profits. Make-sell amazing anti-freeze solution for autos. Will not freeze at 22 below. Made in few minutes. Send only 25c today for formula. Allied Research, 2217 N. Kilbourn, Chicago.

FREE Plan shows how to make money at home, spare time, no peddling or canvassing. Special introductory offer. Enclose dime to cover handling expenses. Dept. 9, Cocheco Libraries, Dover, N. H.

HOUSE To house—20th century medical remedy. 100% profit to workers. Exclusive territory to producers. Write Box 254, Trinidad, Colo.

SELLS Like hot cakes. Big profits. New laundry soapflakes. Perfumes clothes lastingly when washing. Territory given. Sunset Laboratories, Lynbrook, N. Y.

AGENTS Wanted. Men, women. Fastest selling article on market. Absolutely new; demand already created. Every home a prospect. Big profits. S. C. L. Sales Agency, Montgomery, W. Va.

$6.00 HOURLY. Amazing Karnu refinishes autos like new without rubbing, polishing, waxing or painting. Wipes on with cloth. Lasts 8 to 12 months. Free sample. Karnu, Dept. C-108, Cincinnati, Ohio.

GENUINE Gold letters for store windows. Easily applied. Free samples. Liberal offer to general agents. Metallic Letter Co., 438-B North Clark, Chicago.

100% PROFIT In the mystery cigar lighter. No flint or friction. What makes it light? No wind can blow it out. Retails 25c. Sample and sales plan 25c. New Method Company, Desk PM-23, New Method Bldg., Bradford, Pa.

STRANGE Ironing cord. Prevents scorching. Saves electricity. Abolishes kinks, snarls. Approved by Good Housekeeping. For telephones also. 140% profit. Samples furnished. Neverknot, Dept. 11-A, 4503 Ravenswood, Chicago.

AGENTS—New auto drain plug going wild! Button control on dash drains oil; no getting under car. Saves half oil bill. Priced so low everybody buys. Free sample offer! Write Toman Sales Company, Dept. R-210, 2621 W. 21st St., Chicago, Ill.

MAKE Big money! Commissions advanced. Sell raincoats and zipper jackets. Latest style and quality. Lowest prices. Experience unnecessary. Outfit free. Goodyear, H-712 Roosevelt, Chicago.

300% PROFIT Selling new "20-in-1" kitchen utensil. Retails 25c. Costs you $1.00 a dozen. Sample 10c. New Method Co., PMM-23, Bradford, Pa.

NEW Silver tinseled Christmas signs, 9"x12", cost 3½c, retails 25c, sample free, clean up this Christmas! Lowy, 8 West Broadway, New York.

GOLD Embossing ink. Engrave Christmas cards. Farrand Chemical Company, Tyrone, Pa.

DISTRIBUTORS: New door knocker and keyhole illuminator. Territory open. Knocker-Lite Company, 3292 West 125th Street, Cleveland, Ohio.

WALL Papers, paints, wholesale. Large savings. Advice given. Samples. Paint Shop, 218 Division, Grand Rapids, Mich.

MARRIED Man with spare time to distribute free samples coffee, flavoring, food products and make customers. Must devote at least two hours daily and be satisfied with up to $3 in an hour. Permanent. Blair, Dept. DFS 17, Lynchburg, Va.

IF You want to get your groceries and household supplies at wholesale, and a wonderful chance to make $15 a day besides, send me your name immediately. No experience necessary. Albert Mills, 4672 Monmouth, Cincinnati, O.

SENSATIONAL New 15c scissor sharpener proves amazing seller. Make 200%. Sample, details 10c. Dandee Company, 14 North Sixth Street, Minneapolis, Minn.

DOUBLE-EYED Self threading needle packages, size 3/9. Blind people thread them, invaluable for failing sight, necessary for good sight. Sample, particulars 10c. Agents wanted. Wm. Oglesby, Vandalia, Ill.

SALES Kit free. Write for our free offer and catalog of household deals, cosmetics, extracts, etc. Make big money selling your friends and neighbors. Clyde Collins Chemical Co., Dept. PM-10, Memphis, Tenn.

AGENTS! Sell burglar-proof window locks! Every home needs 10 or more. Sample free! C. Franck, 10100 Harper, Detroit, Michigan.

OUTSTANDING Seller, Sobrite metal polishing cloth. Steady repeater. Sample free. Peer, 32P Union Square, New York.

AGENTS: Smash go prices! Santos coffee 12c lb. 4-oz. vanilla 8½c. $1.00 size tonic 14c. Razor blades, 10 for 8½c. 100 sticks chewing gum 12c. Christmas cards, 21 in box, 14c. 150 other bargains. Experience unnecessary. Write Carnation Co., PO, St. Louis, Missouri.

SELL "Lucky Seven" Christmas packages! 25c seller—20c profit! Big flash! Particulars free. Three packages 25c. Elfko, 523 South Dearborn, Chicago.

SELL By mail: 36 paged prospectus and catalog, 3c. Smith Novelty Jobber, Miami-Beach, Fla.

500% PROFIT Strong vanilla flavoring $.01¼ ounce. Mann, Box 1819, Milwaukee, Wisconsin.

$2.00 HOURLY With new, scientific cream that mends all cloth easily, quickly, invisibly, without needle and thread. Stands laundering. Free sample. Sew-No-More Co., Dept. C-744, Cincinnati, O.

MAKE Products yourself. Formula catalog free. Kemico, 45, Parkridge, Ill.

BEAUTIFUL Foil window sign letters. Penny each. Popular sizes. Easily applied. Samples, complete working equipment free. Atlas Sign Work, 7941 Halsted, Chicago.

REGULAR Income; home, office, no canvassing. McArthur Co., Desk 5, Butte, Mont.

$50.00 WEEKLY. Sell 5 glasses California orange jelly, 25c. 200% profit. 5 glass sample 25c. Cutter-Clarke, 5515M Ruthelen, Los Angeles, Calif.

1000 BEST Sellers, blades 65c hundred, needle books 25c dozen. Free wholesale catalogue. Paty Company, 5P Elston, Somerville, Mass.

AGENTS Wanted. Men and women can make good profits selling new attractive office specialty. Pleasant work with splendid possibilities. Torit Mfg. Co., St. Paul, Minn.

CHRISTMAS Cards—21 card assortment sells fast at 60c! Send 30c for sample box, or particulars free. New England Art, North Abington, 86, Mass.

MAKE More money selling shirts, ties, underwear, dresses, hosiery, raincoats, sweaters, coveralls, pants, uniforms. Outfit free! Nimrod Company, Department 8, 4922-28 Lincoln Avenue, Chicago.

NEW $30.00 Value radio given in "free deal." Earn up to $100.00 weekly. New sales plan. Also auto radios. Meritone Mfg. Co., 3857 North Hamilton, Chicago.

FREE Literature describing many money making plans. Belfort, 4042 N. Keeler, Chicago.

SUCCEED With your products. Learn how. Formulas. Processes. Analytical service. Catalog free. B. Thaxly Co., Washington, D. C.

CASH Income daily resilvering mirrors at home. Replating autoparts, tableware, etc., outfit furnished. Write Sprinkle, Plater, 128, Marion, Ind.

OPERATE Home mail order business, selling our products. Everything furnished. Superior Specialties, Springfield, Ill.

150% PROFITS In stationery monogram sets. .Box 150, Wausau, Wisc.

TEN To thirty dollars a day easily made with Quixnue, the entirely new and sensational automobile and furniture permanent beauty treatment. No rubbing or polishing. Get free sample and details. General Paint & Chemical Co., Cincinnati, O.

AGENTS—Engraved name plates, number plates, signs, etc., easily sold, profits large. Brett Bros., Winthrop, Mass.

PORTRAIT Agents throughout the world, get my free catalog, portraits, frames. Lowest prices. Picture Man Friedman, Dept. 9, 528 Cornelia, Chicago, Ill.

BIG Money applying gold initials on automobiles. Easiest thing today. No experience needed. Free samples. "Ralco," 1084 Washington, Boston, Mass.

MAN In each town to plate auto parts, reflectors, bathroom fixtures, refinish beds, mirrors, chandeliers; by new method. No capital or experience required. Simple plan of manufacturing at home starts you in big money-making business . Outfit furnished. Free particulars and proofs. Gun Metal Co., Ave. H, Decatur, Ill.

BIG Money and fast sales. Every owner buys gold initials for his auto. You charge $1.50; make $1.45. Ten orders daily easy. Write for particulars and free sample. American Monogram Company, Dept. 40, East Orange, N. J.

AGENTS—Opportunity to make money; book containing 87 successful business plans; home or office; send for free introductory booklet. Elite Co., 214 Grand St., New York.

AGENTS: Stamping names on pocket-key protectors. Sample check with your name, address, 25c. Stamping outfits. Emblem checks, check-fobs, name plates. Hart Mfg. Co., 303 Degraw St., Brooklyn, N. Y.

AMAZING Cleaner. Cleans everything. Sample free. Bestever, 5007P Irving Park, Chicago.

A BUSINESS Of your own making sparkling glass name plates, numbers, checkerboards, medallions, signs. Booklet and sample mailed free. E. Palmer, 512, Wooster, Ohio.

PROFITABLE Home business. Legitimate. No canvassing. Maywood Publishers, P-923 Broadway, New York.

OUTSTANDING Easy selling products. No competition. Sample 10c. Mint Co., Baroda, Mich.

SELL Made to measure raincoats. Outfit free. Goodyear Rainwear, 18 West 22nd, New York.

EARN Money at home. Easy dignified proposition. No canvassing. Hetzel, 802 Garden, Hartford, Conn.

BE Independent. Own your business; experience unnecessary, selling $10,000 accidental death, $50 accident; $25 sick weekly benefits—$10.00 yearly. Other amounts proportionate. Guaranteed steady renewal income. $250,000 deposited insurance department. Universal Policy, 716-A Lefcourt Bldg., Newark, N. J.

INITIALING Automobiles biggest money maker today. New type requiring no varnish to apply. Write for samples. International Monogram & Transfer Co., Box 6365, Philadelphia, Pa.

MAKE Products yourself—Tested formulas. Catalog free. Grinstead Laboratory, Edwardsville, Ill.

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YEAR'S Income in 3 months! New federal, state and code laws create immense demand for simplified record system every businessman must have to protect himself against fines and penalties. Millions users must buy again now. Our men selling 5 to 25 daily our officially approved, copyrighted Liberty Tax Record. $3.50 cash profit every sale. Repeat commissions without callbacks. Live leads furnished. Big season now. Choice territories going fast. Commonwealth Publishing Company, 508 So. Dearborn, Chicago.

MEN Wanted by world-wide industry—Apply by letter only giving age, experience, references. Industry and reliability main qualifications. Man selected will become authorized Rawleigh dealer on our capital and taught how to establish a profitable business in over 250 farm and home necessities. Man with auto preferred to introduce products and travel steadily. Write immediately. Rawleigh, Dept. K-N-PPM, Freeport, Ill.

CALL On gas stations, garages, stores. New chemical sponge, whirlwind seller. Cleans automobiles without work. Phenomenal profits. Outfit free. Kristee, Box 1441, Akron, O.

AUTO Accessory salesmen: Complete line fastest sellers. Prices dealers want to pay. Big commission daily. Exclusive territory. National, 1910-BG Wentworth, Chicago.

EVERYBODY Buys business stationery. New items. Highest quality. Lowest prices. Free cuts. Quickest delivery. Big comm. daily. Experience unnecessary. Self selling outfit free. David Lionel Press, 312 South Hamilton, Dept. F, Chicago.

LIBERAL Cash earnings daily plus extra cash bonuses representing leading manufacturer men's fine shirts, ties, hose, underwear, pajamas, raincoats, ladies hose. Sensational free outfit makes easy sales. Write Dept. L10, Sterling, North Bergen, N. J.

SALESMEN: Acquainted with garages, filling stations, to handle local business. Write Colgra, 2624 N. Third St., Milwaukee, Wisconsin.

TAILORING Sensation! Sell men's suits! $6.95 and commission $3.00. Bonus. Suit furnished. Free outfit. Also lowest priced rainwear line. Service, DA-1617 N. Damen, Chicago.

MAN—Handle regular store route. Place nationally advertised 5c-10c counter card mdse. New aspirin deal. 16 tablets 10c. 85 more fast sellers. 100% profit. No investment. Catalog free. World's Products Co., Dept. 11810, Spencer, Ind.

SALESMEN Calling on hardware, oil burner, plumbing trade. Write SSS, 138 Holden, Minneapolis, Minnesota, for details.

MARVELOUS New specialty, lace transparent stenocuffs. 180,000 pairs sold last winter. Season is on! You should earn $20 daily. Write for details. Sameco Stenocuff Corp., Brockton, Mass.

GO Into wholesale business without investment. Call on stores with biggest line self-selling counter displays: Aspirin, razor blades, handkerchiefs, breathlets, household cement, 79 different items. Up to 125% profit for you. Experience unnecessary. Write for catalog and plans. Procopax, Dept. 36-CD, 1956 S. Troy, Chicago.

AMAZING Money maker! Ladies' genuine steerhide leather handbag at almost half regular price. Big commissions. Lifetime quality. New, exclusive features. Two zipper compartments. 22 karat gold engraved name and initials. Free coin purse, mirror, key case. Holiday sensation. Sells on sight. Free sample offer. Halvorsen, Dept. A-6, Chicago.

SALESMEN Calling on all classes retail stores to sell the new Economy—low priced—efficient show window lighting units. Protected territories, good profits. Act at once, winter season just starting. Carlon Products Company, 1210 East 113 St., Cleveland, O.

EVEN Temperature hot-air circulator. Sells $1.50 to every household, big profits. Schillinger, 1437, Tulsa, Okla.

MAKE Big money steady. High grade coveralls, shopcoats, pants, shirts, summer suits. Advertising on back. Fast sellers. Free outfit. Strong Mfg. Co., 901 West Jackson, Dept. N-9, Chicago.

SALES Books and labels. Sell sales books in small quantities at attractive prices, also "Allpurpose" pocket label that sells at every stop; good commissions. Technocraft, 81 Kingston, Boston.

$5 SPOT Cash on every $6 sale! Connect with a winner. Earn up to $20 daily. New plan of protection at cost. Everyone a prospect. Free outfit explains fully. Provident Aid Society, Dept. M-527, South Bend, Ind.

NEWEST, Most amazing deal for stores, shops. Inexpensive. Big business increase or money back. Gold mine for salesmen. Outfit free. Stimulators, 343 Madison, Chicago.

PERFUMED Business cards illustrated in several colors. For many lines of business. Sell fast to merchants dealing with feminine trade. Robert, 1458 E. 17th, Cleveland.

BIG Money in tire patches. Sell new auto tire patch to service stations, garages, etc. Tiger-Grip patches guaranteed 10,000 miles. $75 weekly for salesmen or distributors. Protected territory. Write Economy Rubber Co., 721 Burkhardt, Dayton, Ohio.

AMAZING Zipper pinless clothes line. Lightning demonstration, sure sale every home. Free guarantee sales plan. Dunn Bros. Hempstead, N. Y.

WONDERFUL Opportunity. $20.00 a day can be earned. No experience necessary. You can start at once. Showing the latest thing out. Self protection and home protection at cost. Ages 1 to 80. Not insurance but provides benefits up to $1000.00 natural or accidental death. $20.00 per week if sick or injured. Address National Aid Society, Dept. B, Springfield, Ill.

BRAND New grab-bag deal. Going big everywhere—big profits—swift sales—fast repeats. No restrictions. All dealers buy. Act! K&S, 4373 Ravenswood, Chicago.

PENNY Each, popular sizes. Non-tarnishable window sign letters. Enormous profits. Free working equipment, samples. Record breaking offer. Atlas Sign Works, 7941 Halsted, Chicago.

MAKE More money selling shirts, ties, underwear, dresses, hosiery, raincoats, sweaters, coveralls, pants, uniforms. Outfit free! Nimrod Company, Department 65, 4922-28 Lincoln Avenue, Chicago.

SOMETHING New in fire extinguishers. Red Comet automatics. Proved in west five years. Exclusive territory. Low price opens pocketbooks. Write Red Comet, 404 Comet Building, Littleton, Colo.

SALESMEN—Sell collection systems. 400% commission. Sayers Systems, 2801-123 Sheffield, Chicago.

STICK-ON Window sign letters. 500% profit. Free samples. Metallic Co., 438-A N. Clark, Chicago.

NEW Specialty—Sells every business and professional man. Four $15 sales daily pay $280 weekly. Foyer cleared $4920 in three months. Write, F. E. Armstrong, President, Dept. PM, Mobile, Ala.

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EARN Quick cash raising mushrooms in cellar, shed, attic. We buy crops. Guaranteed materials furnished. Easy. Odorless method. Book free. United, 3848-AU Lincoln, Ave., Chicago.

GROW Mushrooms. We show how. Use cellar, shed, etc. Plant now. Overnight crops. Splendid income. Data free. Interstate, NX-7357 Cottage Grove, Chicago.

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WE Purchase all Indianhead pennies. Pricelist 10c. Photopennies, 100 Forsyth, New York.

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DOCTOR Of theotherapy home-study. Bulletin 10c. Abbey, South Whitley, Ind.

BECOME An investigator. Write former agent United States secret service Joseph Kavanagh, PM-114, Hoboken, N. J.

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SHORT Stories revised, typewritten, marketed. Write for details. Hursh Service, Box P-1013, Harrisburg, Penna.

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EXTRA Money: Our practical plans for winners. Write today. Hunt Products Co., Box 202, Trenton, N. J.

1000 CARDS $1.40. Illustrations. Anything printed. Bradshaw, 3214 Huron, Chicago.

STATIONERY, Circulars, checks, loose-leaf, ruling, binding. Commercial Press, Batavia, Ohio.

BETTER Grade printing, reasonable priced. Free samples. Economic Press, Leonia, N. J.

1000 BUSINESS Cards, card case, $1.50. Miller, Printer, Ambler, Pa.

1000 LETTERHEADS, Envelopes, circulars $2.95. Low prices leaflets, folders, catalogs. Mimeographing. Multigraphing. Samples. Frazer Press, Box 45-D, North Topeka, Kan.

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LITHOGRAPHING, Printing presses, $4.00 up. "Bargainlists," 1354 Hayden, Cleveland. (Stamp.)

HAND Press, type and complete printers' supplies. Advise equipment you need and we quote prices; or send stamp for catalog. P. Peiffer, 15-A, 6 Columbia St., Newark, New Jersey.

USED Press bargains. What size do you want? Send stamp for reply. Exchange D-1. 480 E. Main, Meriden, Conn.

PRINT Your own cards, stationery, circulars, advertising, etc. Save money. Easy rules furnished. Print for others, big profits. Junior press, $5.90; job presses, $11; power, $149. Write for free catalog and full information. Kelsey Co., T-11, Meriden, Connecticut.

BUILD Your own press. Material costing less than $1.00. Detailed instructions 20c. Earle Nason, 19 High, Somerville, Mass.

PRINTING Presses and supplies. Lists 3c. Popular Bargains, Richland, Pa.

PRINTING Presses, type, supplies. Lawrence, 1426 South St. Francis, Wichita, Kans.

BARGAINS Used presses, type. Send stamp. Box 15, Cambridge, Mass.

PRINTING Outfits—Presses, type supplies, type novelties. Send stamp for catalog. Model Press, York, Penna.

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1. WHAT Is the only effective way to protect an invention? See page 43A.

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2. WHAT Is the first step in making application for patent? See page 43A.

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4. TO What president was issued patent for expanding air-chambers to lift river boats over sand bars? See page 43A.

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3. HOW Many patents were issued to Thomas A. Edison? See page 43A.

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7. IS It compulsory to prepare a working model before making application for a patent? See page 43A.

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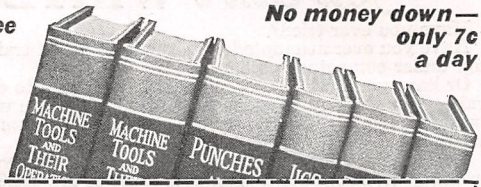

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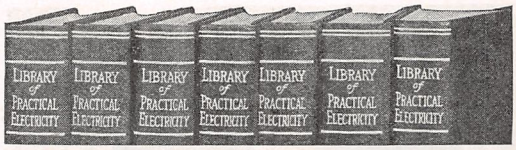

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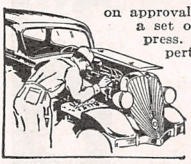

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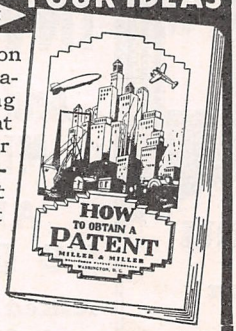

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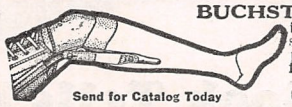

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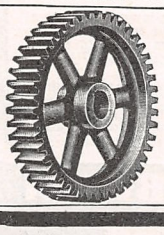

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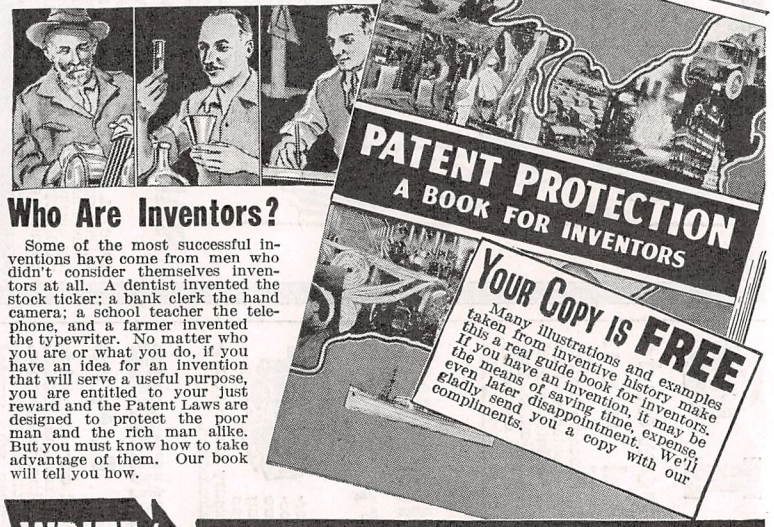

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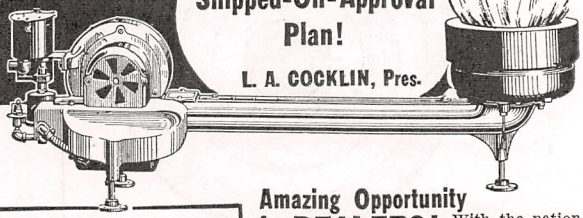

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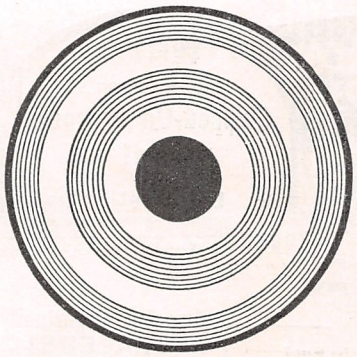

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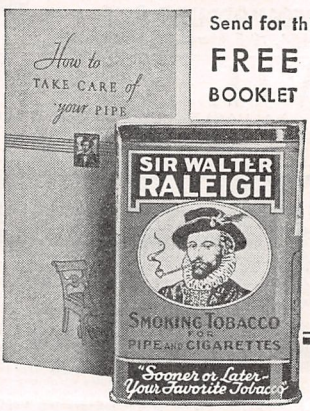
Clean out the old pipe, friend. Pack it with Sir Walter Raleigh Smoking Tobacco. Then puff away and watch your Sweet Mama smile again. Sir Walter Raleigh has a mildness that wins you, and a delicate fragrance that wins others. Sales of this choice Kentucky Burley blend have boomed because it really *has* the mildness mankind is searching for. Try a tin . . . will ya, man?

Brown & Williamson Tobacco Corporation
Louisville, Kentucky. Dept. P-411



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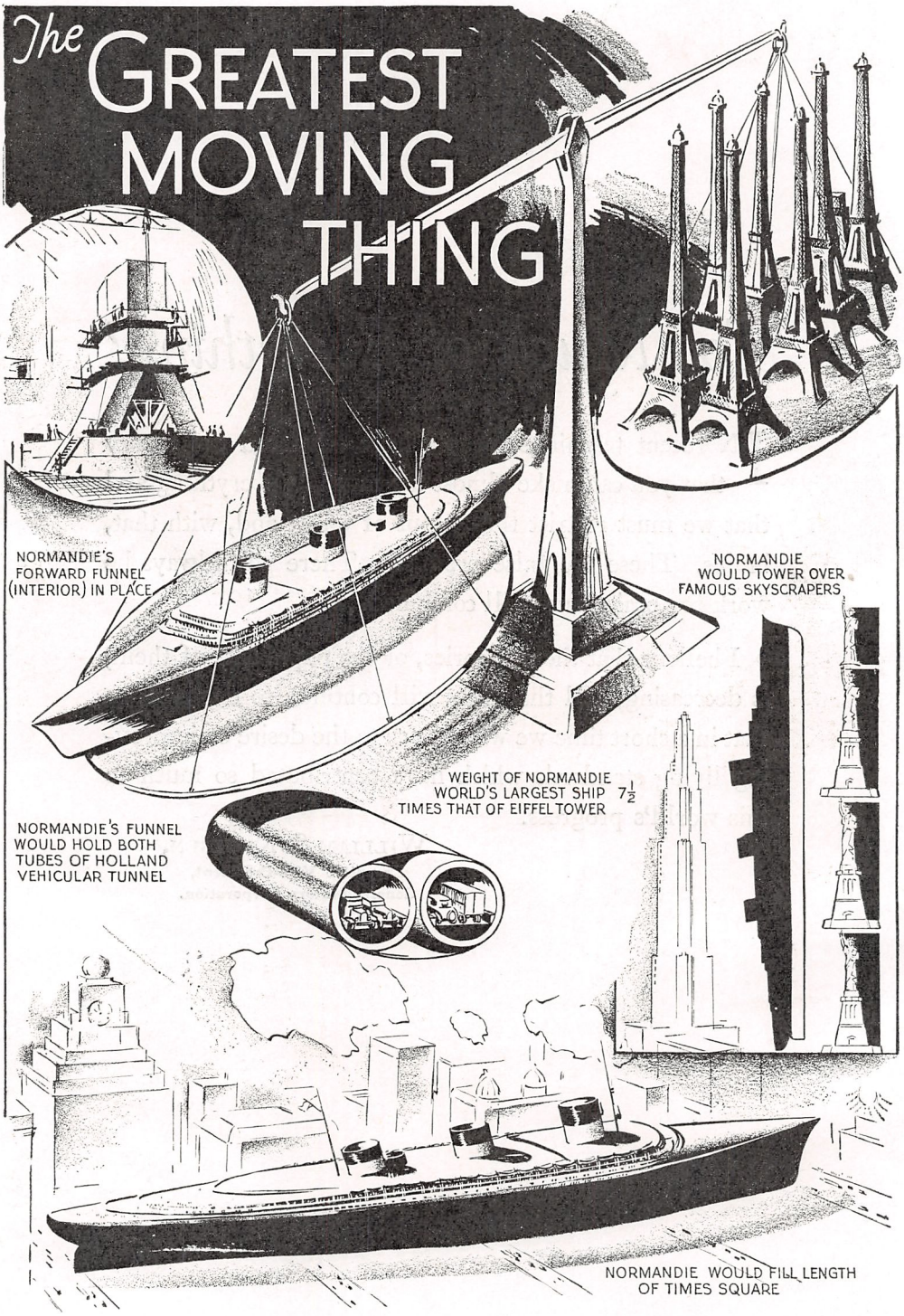
It's 15¢ —AND IT'S MILDER

Too Much of Everything?

IN recent teachings, people have advanced the theory that you can make almost too much of everything and that we must restrict the output of effort and, with that, brains. These are false premises. There will always be work for brains and skill combined.

I believe that these theories, or the popularity of them, is decreasing, and that they will continue to decrease, so that in a short time we will return to the desire of improving living standards which have contributed so much to this world's progress.

WILLIAM S. KNUDSEN,
Executive Vice-President,
General Motors Corporation.



The French Liner "Normandie" Will Make Most Present-Day Ships Look Like Pygmies; It Is 1,027 Feet Long, 119½ Feet Wide, 128 Feet High and Is of 75,000 Gross Tons

Popular Mechanics Magazine
REGISTERED IN U. S. PATENT OFFICE AND CANADA
WRITTEN SO YOU CAN UNDERSTAND IT

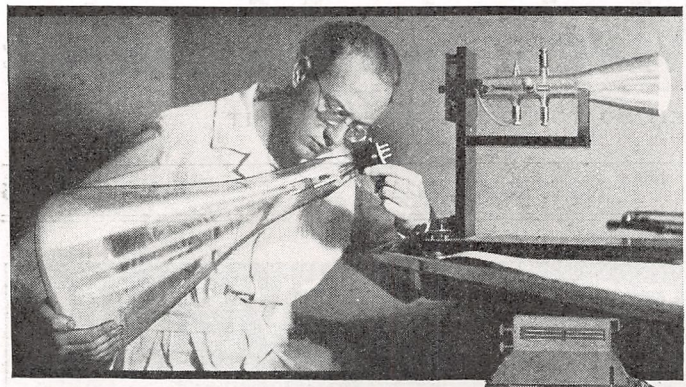
Vol. 62 NOVEMBER, 1934 No. 5

The LATEST in TELEVISION

TELEVISION is becoming a practical reality in Germany where a method of transmission has been developed which utilizes both radio and motion-picture film. The mobile unit which broadcasts the pictures is a truck equipped to make sound movies.

After the sound pictures of an event have been taken, the film is developed aboard the truck, a process requiring only a few minutes. The film is then submitted to a scanner and the beams of light are changed into radio waves with the aid of a photo-electric cell. These waves are then broadcast, the method making it possible to take sound movies of an event like a baseball or football game and transmit the pictures

Television Image on Cathode-Ray Tube; Below, Truck Which Makes Sound Movies and Transmits Film by Radio Thus Making Possible the Televising of Sports Events



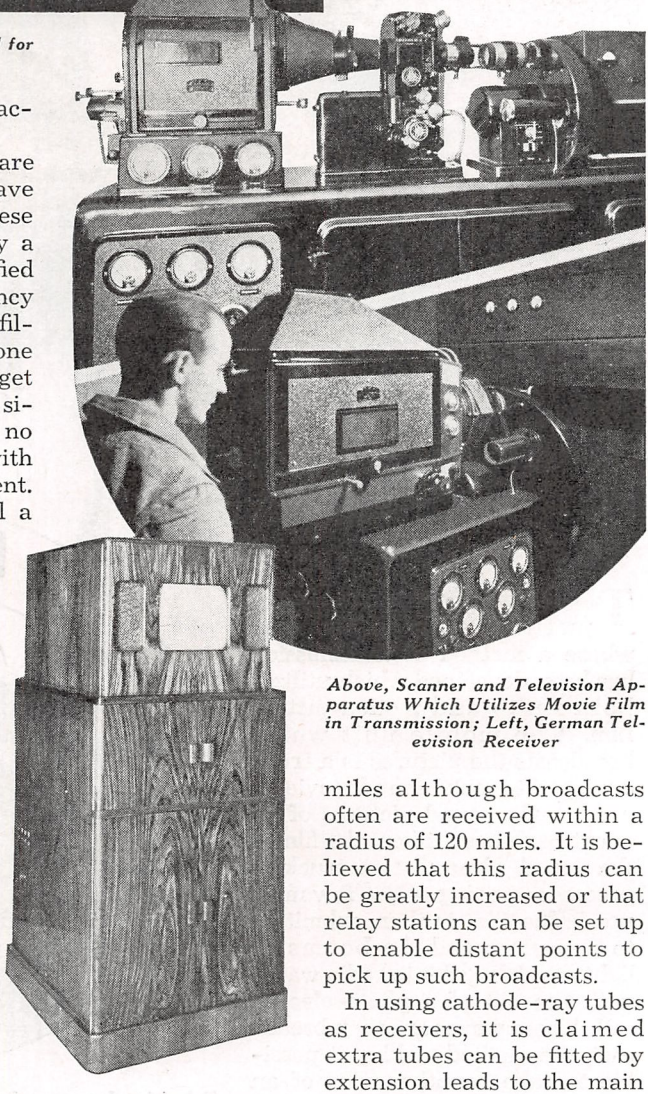
Above, Large Cathode-Ray Tube Used for Receiving Television Images

only a few minutes after the action has occurred.

Sound and vision programs are transmitted on neighboring wave lengths but on the receiver these two carriers are picked up by a common aerial circuit, amplified by the common high-frequency stage and then detected and filtered separately. Thus only one tuning control is necessary to get the sound and vision program simultaneously and there is no chance of receiving a picture with the wrong sound accompaniment. By turning the tuning control a little to one side, sound can be received without the picture, and by turning to the other side a silent picture can be received.

A German radio engineer has developed an exceptionally large cathode-ray tube which receives images about seven by nine and one-half inches. The system for synchronizing sound and action is operated entirely by wireless with the aid of special impulses which are transmitted by the Berlin broadcasting system. The tube in which the images are viewed and the loud speaker bringing in the sound are contained in a cabinet no larger than an ordinary radio receiver and such sets are being made to retail for about $200. Due to the fact that the cathode-ray tube which shows the image also acts as a rectifier, the loss of energy is not as high as usual with this form of apparatus and pictures are much clearer as a result.

The television trucks broadcast on a seven-meter wave and have a working radius of forty

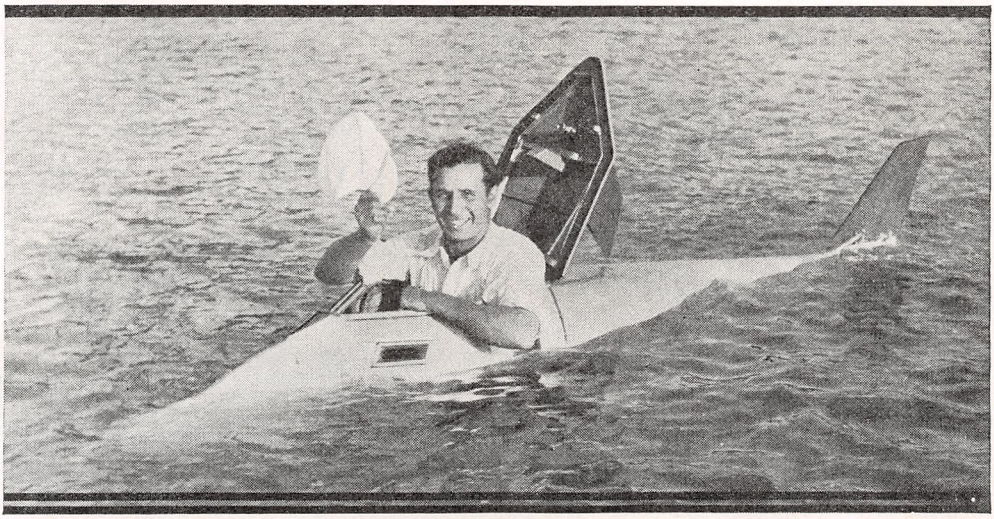


Above, Scanner and Television Apparatus Which Utilizes Movie Film in Transmission; Left, German Television Receiver

miles although broadcasts often are received within a radius of 120 miles. It is believed that this radius can be greatly increased or that relay stations can be set up to enable distant points to pick up such broadcasts.

In using cathode-ray tubes as receivers, it is claimed extra tubes can be fitted by extension leads to the main set, just as extension loud speakers are added to the radio.

Midget Submarine Runs Six Miles an Hour



Resembling a Large Fish, This One-Man Submarine Has Been Tested Successfully in Lake Waters; Its Inventor Is Shown after Making Another Test Run

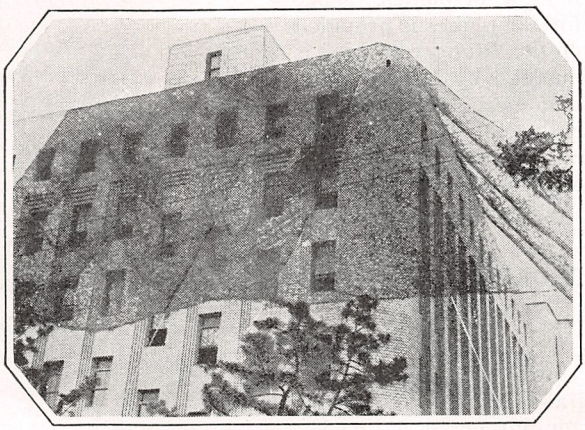
Resembling a large metal fish, a ten-foot submarine has been undergoing tests in the vicinity of Chicago. Weighing 1,000 pounds, the midget craft has a cruising speed of six miles per hour and submerges to a depth of seventeen feet. It has space for the inventor-operator to shift his controls easily.

MANY MILLION ACRES RUINED BY EROSION OF SOIL

Unrestrained soil erosion is building in America a new public domain of worn-out and severely impoverished land, says H. H. Bennett, director of soil-erosion service of the department of agriculture. He said seventy-five per cent of the land in this country is subject to some degree of washing when used for cleaning tilled crops or severely over-grazed and estimated 35,000,000 acres of land have been made essentially worthless by rain-wash, and the loss to this country occasioned by erosion is equivalent to 140,000 farms of 250 acres each. Simple methods of checking erosion are known, and, in the main, consist of changes in the farm set-up, terracing, strip farming, contour plowing, rotation of crops and putting hillsides back into trees or grass.

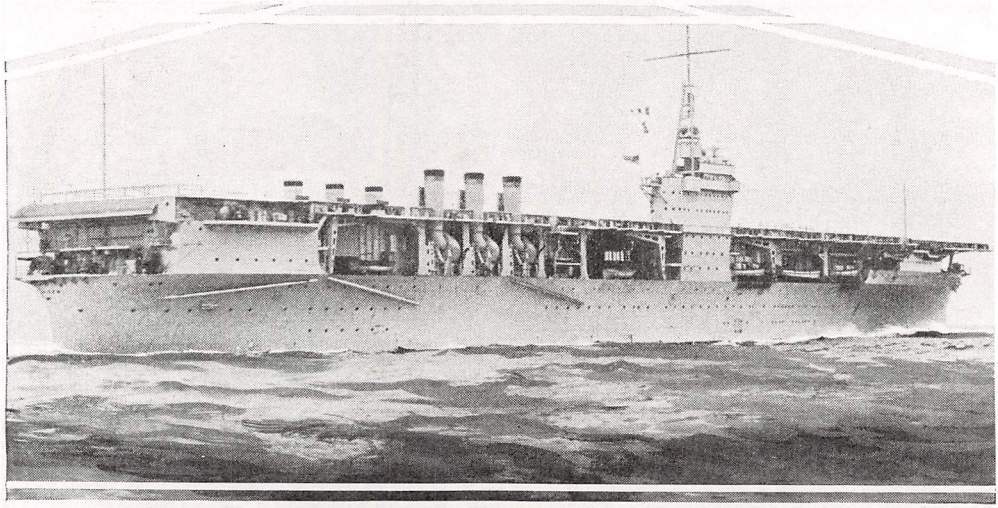
BUILDING CAMOUFLAGED BY NET TO FOIL AIR ATTACK

Hiding large buildings from the eyes of airplane observers is accomplished in Japan by shrouding the structure with large nets. The net has an effect similar to that produced on ships and airplanes by camouflage paint applied in odd streaks. The net was used to demonstrate methods of foiling an attack from the air.



Net Is Shown Drawn over Upper Portion of Building in Japanese City as Latest Means of Camouflage during War Games

Navy's Latest Plane Carrier Is Fast in Trials

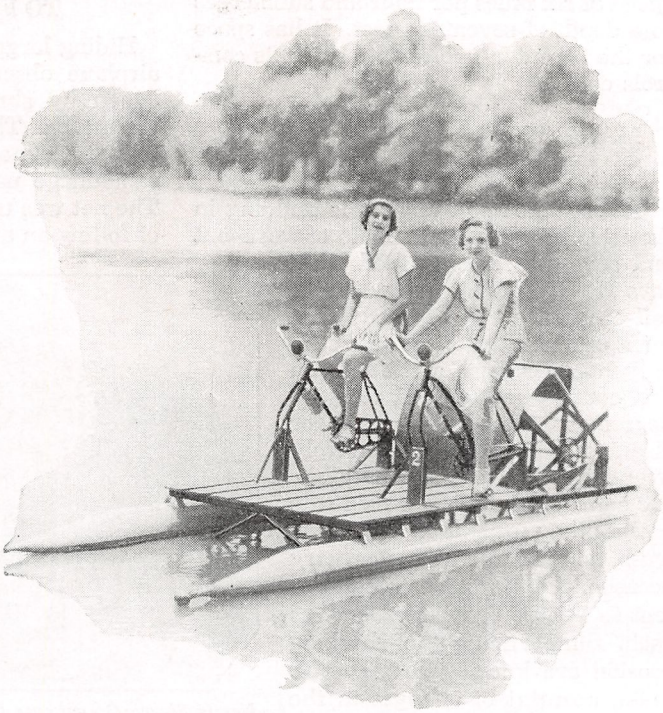


Here Is the Navy's New Plane-Carrying Vessel, the First Built Especially for That Purpose; Folding Funnel Is One Feature of the Ship, Named "Ranger"

Stretching her sea legs for the first time off the Maine coast, the U. S. Navy's new plane-carrying ship developed high speed, turning up to twenty-eight knots. The craft is the first American vessel planned specifically for carrying airplanes. The others, "Saratoga," "Lexington" and "Langley," were converted from other types of ships. The latest carrier, "Ranger," is 765 feet long with broad decks to facilitate landing of planes. Space for 126 planes is provided on the "Ranger," which is manned by 1,100 officers and men. A feature is a collapsible funnel that can be shifted to horizontal position when planes are alighting.

PEDAL-DRIVEN BOAT ON PONTOONS

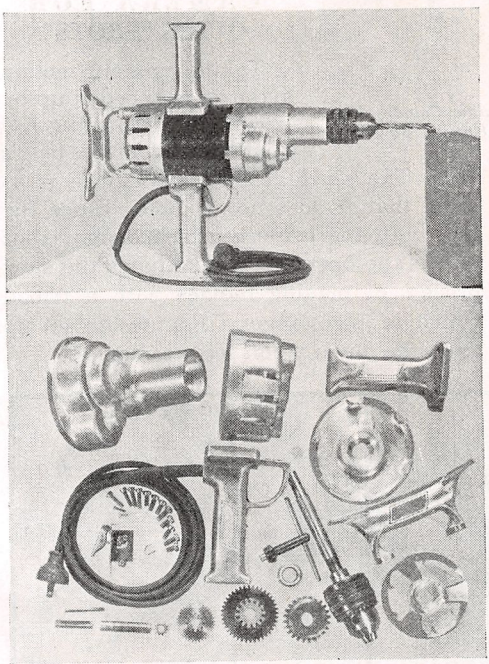
Propelled like a bicycle, a pontoon boat for two passengers is proving popular on St. Louis lagoons. The craft consists of two pontoons supporting a platform on which are mounted two bicycle frames ridden tandem fashion. The pedals turn a paddle wheel mounted at the rear.



Pontoon Boat Operated by Pedals Which Turn Paddle Wheel at the Rear

ELECTRIC DRILL EASY TO BUILD OF OLD GENERATOR AND KIT

By using an old model-T Ford generator and a special kit, almost anyone can build an electric drill at home. The generator is used as the motor, no change being made in the field coils. Complete instructions are furnished for conversion to motor purposes. Drill, gears, chuck and other parts are supplied with instructions for assembling. The drill shaft operates at 370 revolutions per minute in two renewable phosphor bronze bearings of large size. The drill operates at a speed found suitable for drilling a wide variety of metals. It runs on 110 volts, either alternating or direct current, and thirty-volt operation can be obtained if specified.



Top, Electric Drill with Generator in Center; Bottom, Parts Used in Assembling Drill

LIFE-SIZE ANIMALS ARE BUILT FROM SMALL MODELS

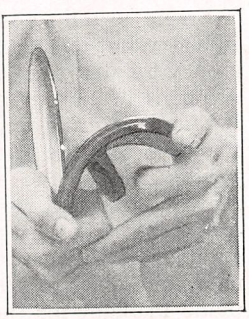
Small models of animals found in Africa are serving to guide workmen engaged in constructing full-size mountings of animals in the African hall of the Academy of Science building in San Francisco. Frank Tose, director of exhibits, spent fourteen months in Africa gathering plant life,

Model of Giraffe Which Was Used in Constructing Life-Size Animal for Museum

making paintings and plaster models from which the animals could be mounted in life-like surroundings. One life-size giraffe in the exhibit is a remarkable feat of taxidermy, mounted with the aid of a small model prepared by the director of exhibits.

AUTO MIRROR IN RUBBER FRAME UNDAMAGED BY VIBRATION

Heavy rubber is used for the frame and post for a rear-vision mirror which fastens to the fender or side of a truck or car. Since the mounting and support are flexible, the mirror is not likely to be broken from vibration caused by fast driving over rough roads, and if it is struck by any object, the post bends with the blow and the glass is unlikely to break.



¶Those wishing further information on anything described in our editorial pages can obtain it by addressing Bureau of Information; please inclose return postage.

How Field Radio Equipment Is Transported by the Italian Cavalry During War Games; Note Position of Aerial on the Horse's Back

CAVALRY CARRIES RADIO SET ON HORSE'S BACK

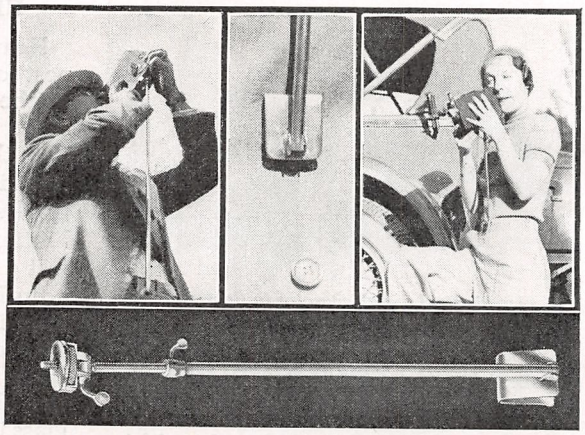
During peace-time maneuvers of the Italian army, radio equipment sometimes is transported by the cavalry by mounting it on horseback. The equipment, including a radio set and aerial, is carried to communications headquarters such as might be set up in the field for use in time of war.

ERRORS BRING HIGH PRICES TO STAMP COLLECTORS

Errors usually cost money in industry but mistakes mean more money for stamp collectors. When someone in the bureau of engraving and printing in Washington makes a mistake and stamps are printed before the error is corrected, there is a rush by collectors to obtain the few "queer" stamps. Several years ago an air-mail stamp was printed showing a plane in flight for the center design. A few were turned out with the plane upside down and collectors rushed to snap them up. Another time a five-cent stamp was turned out in red instead of blue until the mistake was caught, and again collectors profited. Sometimes perforating machines do not work right and the errors bring high prices. Contrary to general opinion, it is not necessarily the age of the stamp which lends it value, but its rarity. As a result some of the error issues today are more valuable than some stamps printed before the Civil war, for stamp collectors are always looking for the unusual.

BELT ROD HOLDS CAMERA FOR QUICK "SHOTS"

Taking amateur motion pictures is speeded up by a camera-supporting rod that hooks over the user's belt. The single leg of the device is so short that it does not wobble. Since the rod, with the camera attached, moves as fast as the operator, it eliminates the slow process of making movies with a tripod which requires several minutes to set up and take down when scenes change.



Showing Some Uses of One-Leg Supporting Rod for Camera; Bottom, the Rod That Hooks over Camera Operator's Belt

¶Inquiries as to makers of articles described in Popular Mechanics, will be answered by our Bureau of Information upon receipt of return postage.

RADIATOR AND BLOCK CLEANER IS EASY TO OPERATE

Automobile radiators and blocks can be cleaned quickly and efficiently by using a unit consisting of a pump driven by an electric motor, supplying a solution to the radiator in excess of the combined capacity of radiator and block, thus cleaning out the clogged openings. The one and one-quarter inch rotor-type bronze pump is driven by a one-horsepower electric motor and delivers as much as sixty gallons of solution per minute. The apparatus is mounted on casters and hence is portable, working parts are enclosed and the cylindrical welded tank contains a conical brass strainer to catch the dirt.

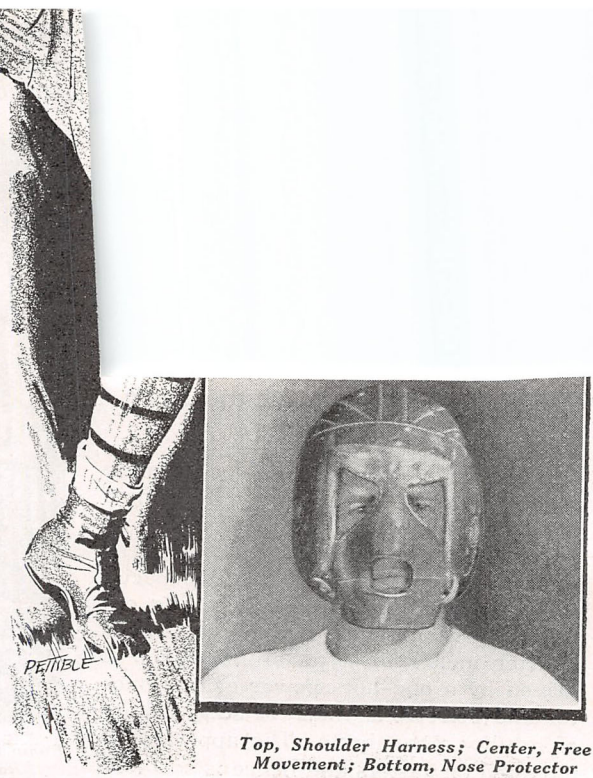
Pump Driven by Electric Motor Which Cleans Auto Radiator and Block Quickly and Efficiently

SLIPSHOD playing and unnecessary injuries are caused by the average football player's careless attitude about his uniform and protective gear. Here's what Erny Pinckert, all-American halfback on recent champion University of Southern California football teams and now a first-rate professional player, has to say about it:

"Famous football stars are particular about the preparation and care of their playing equipment."

Pinckert is applying his knowledge of the game and its problems to the manufacturing of football equipment. He designs gear which allows full use of the body while protecting the danger spots.

Every good player is finicky about the fit of his shoes and his pants. The importance of being particular about shoes is obvious. All players insist on a perfect fit.

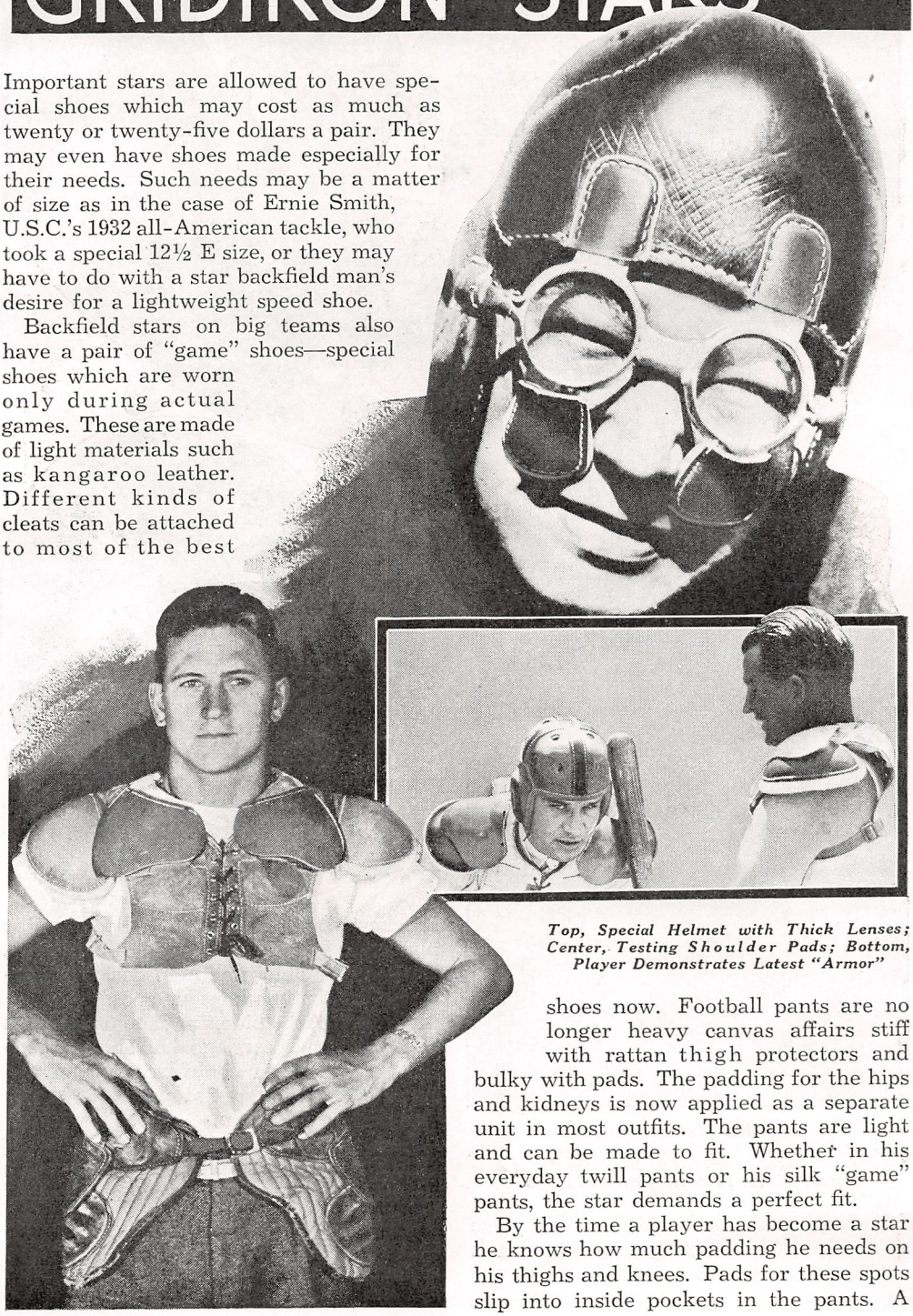


Top, Shoulder Harness; Center, Free Movement; Bottom, Nose Protector

GRIDIRON STARS

Important stars are allowed to have special shoes which may cost as much as twenty or twenty-five dollars a pair. They may even have shoes made especially for their needs. Such needs may be a matter of size as in the case of Ernie Smith, U.S.C.'s 1932 all-American tackle, who took a special 12½ E size, or they may have to do with a star backfield man's desire for a lightweight speed shoe.

Backfield stars on big teams also have a pair of "game" shoes—special shoes which are worn only during actual games. These are made of light materials such as kangaroo leather. Different kinds of cleats can be attached to most of the best shoes now. Football pants are no longer heavy canvas affairs stiff with rattan thigh protectors and bulky with pads. The padding for the hips and kidneys is now applied as a separate unit in most outfits. The pants are light and can be made to fit. Whether in his everyday twill pants or his silk "game" pants, the star demands a perfect fit.



Top, Special Helmet with Thick Lenses; Center, Testing Shoulder Pads; Bottom, Player Demonstrates Latest "Armor"

By the time a player has become a star he knows how much padding he needs on his thighs and knees. Pads for these spots slip into inside pockets in the pants. A

Top, Nose-Protecting Masks; Center, Left, Strips Protect Collar Bone; Oval, Shin Protector and Pads for Injured Knees; Top, (in square) Hip Pads; Bottom, Pads for Protecting Bruised Spots

felt sheath protects the thigh while a piece of sponge rubber usually covers the knee.

"The fellows who most appreciate the importance of their equipment," says Pinckert, "are the ones who become star players in spite of some physical handicap. They either obtain or help design a protector for their vulnerable spot."

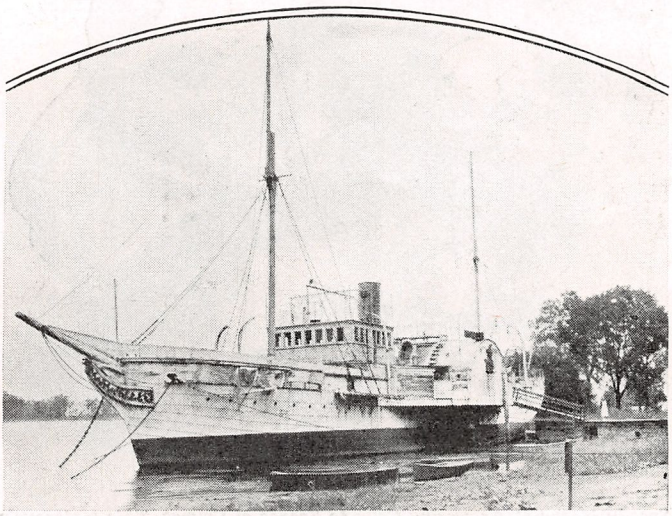
Garrett Arbelbide, a famous end at U.S.C. several years ago, had shins so tender that he never could have played the game without a special protector which was designed for him.

Last year two all-American players at U.S.C. suffered broken noses. They were Aaron Rosenberg, guard, and "Cotton" Warburton, quarterback. Both continued to play with special masks. Warburton supervised the construction of his mask

(Continued to page 136A)

Navy's First Iron Ship Is Ninety Years Old

Built at Erie, Pa., in 1844, the U.S.S. "Wolverine" has the name of being the first iron ship built for the United States Navy. Ninety years later, the famous vessel, now out of commission, is moored on the shore of Misery bay near Erie. While her superstructure reveals the ravages of time, her hull and machinery are in a remarkable state of preservation. The "Wolverine" is 168 feet long, twenty-seven-foot beam, ten-foot draft, with a tonnage of 680. Its paddle wheels are twenty feet in diameter, with sixteen paddles on each wheel. The vessel had a speed of about ten knots. While in commission, it carried six six-pound guns, two two-pound guns and a small howitzer used for signaling.



First of the Navy's Steel Vessels, This Craft Is Shown Moored Near Erie, Pa., with Its Superstructure Showing the Ravages of Time

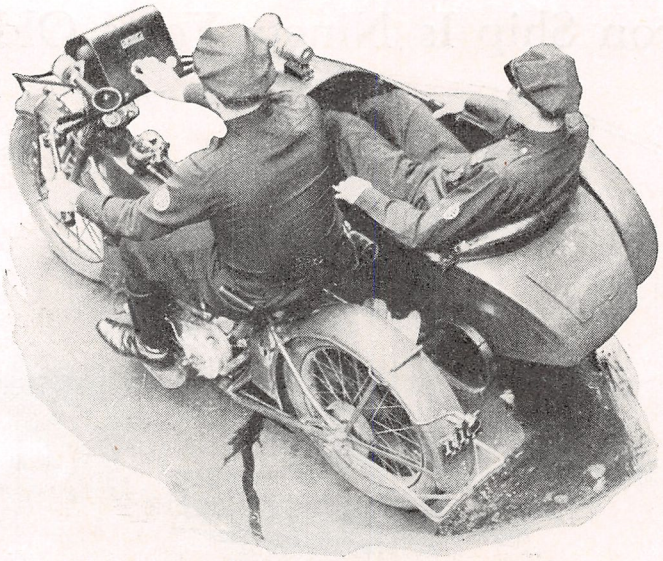
SHATTER-PROOF EYEGLASSES USEFUL FOR ATHLETES

These Eyeglasses Cracked But Did Not Shatter When Pounded with Small Hammer in Severe Test

Eyeglasses containing shatter-proof lenses have been successfully demonstrated in London for the use of athletes, particularly those who play football and baseball. To persons engaged in occupations where there is danger of eyeglasses being broken, the new glasses will be offered as a means of protection. In tests, the glasses crack but do not shatter.

PLATING ON POLISHED METALS GIVES BETTER PROTECTION

Better protection of metals against corrosion is claimed for a new method of plating discovered in England. A scientist was watching the arrival on the surface of polished copper of a minute film of zinc crystals which had boiled over to their new location, owing to rapid heating of an electric wire in a vacuum. As a beam of electrons fell on the surface, the scientist saw about twenty bright circles weaken and vanish. He repeated until the twelfth film of zinc crystals stood fast, indicating the liquid layer of polished copper had absorbed all the crystals possible. When the scientist bombarded polished iron with the crystals, the zinc layer stood fast at the second trial. The effect of the discovery is that whereas films on unpolished metals will stand fast at the first attempt and are soon rubbed off, the films on polished metal can never be totally removed and, in some cases, will efficiently guard against rust and corrosion.



Speedy Means of Answering Calls to Scenes of Crimes, This Motorcycle Has Radio and Sidecar; Note Policeman Turning on the Radio

POLICE CYCLE-CAR WITH RADIO SPEEDS FIGHT ON CRIME

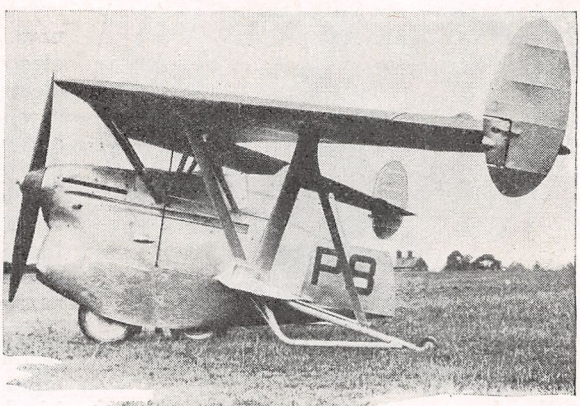
Faster action in their fight on crime is possible for New York police since a squad of radio-equipped motorcycles with sidecars has been placed in service. The motorcycles have been found faster than squad cars in answering calls to the scene of crimes. Two policemen ride the cycle-cars, one operating the motorcycle and one attending to the radio.

GERMS DIE IN RADIO WAVES OF SHORT LENGTHS

Radio waves of very short lengths, four to fifteen meters, are being used in a new device for treating lung abscesses, carbuncles, infectious arthritis and other diseases. The device is an ultra-short wave oscillator. A given wave length seems to affect living matter, like bacteria or germs, to a varying extent, depending on the composition of the living matter. For example, Dr. Erwin Schliephake, of Germany, finds that with the new apparatus he can kill one common type of micro-organism, the staphylococci, in the body, but the rate of speed at which the organisms are killed depends on the length of radio waves used. Cases of actinomycosis, or lumpy jaw, have been cured by waves four meters long, but were unaffected by waves fifteen meters long. Nasal empyema responds to treatment with waves of four to six meters. Plates of glass insulate the new device from the body. It is possible to raise the temperature of the whole body more than seven degrees Fahrenheit in from forty to ninety minutes by means of the oscillator. The short waves seem to weaken the invading bacteria, cause a migration of white blood cells to the site of invasion, and increase destruction of the micro-organisms by scavenger cells of the body.

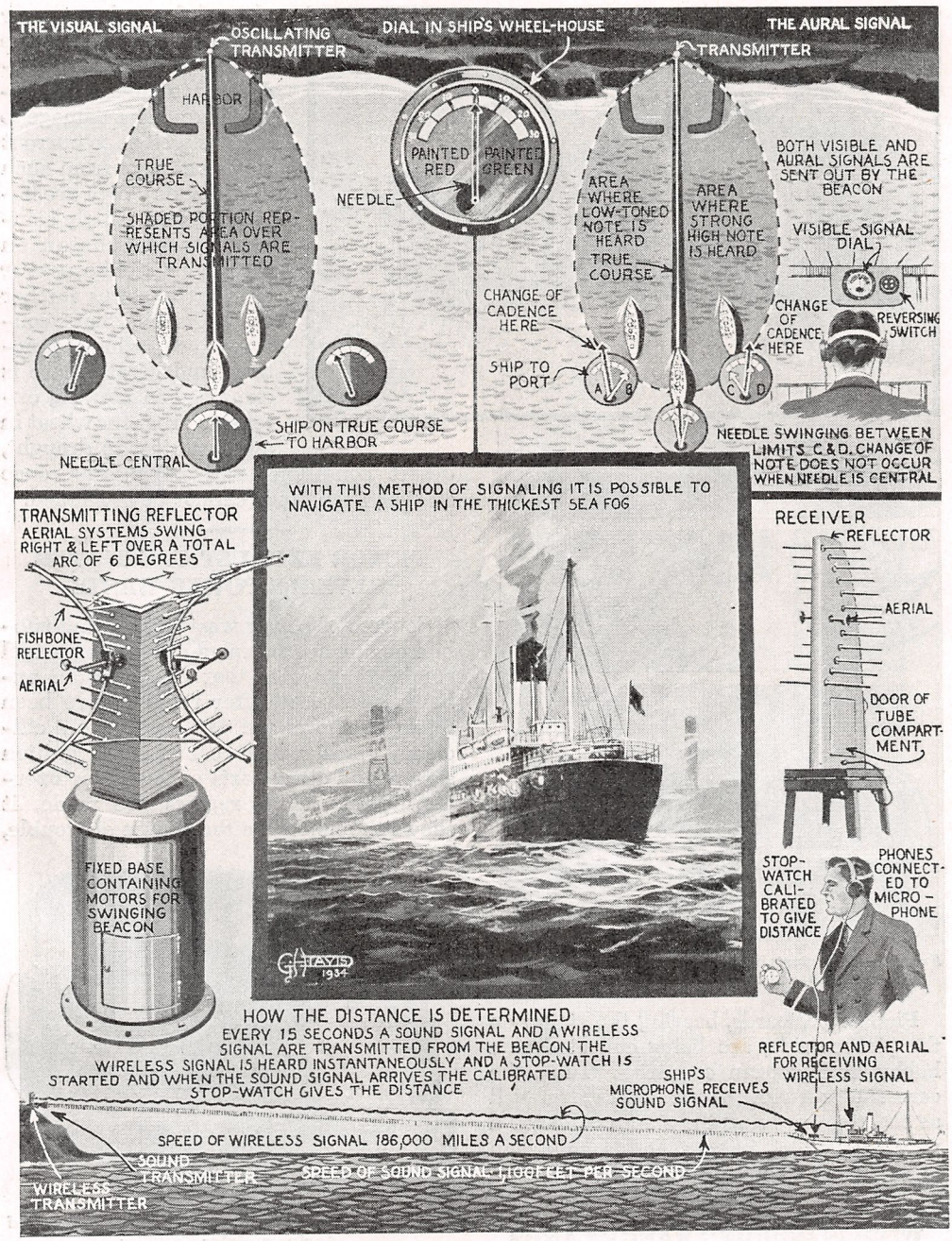
FIGHTING PLANE WITHOUT TAIL RESEMBLES A BAT

Fighting planes without tail assemblies are being tested by air authorities of Great Britain. One of the ships is a two-seater that closely resembles a bat when in flight. Elimination of the tail and after-part of the fuselage increases the field of vision and the field of fire, important advantages for military use.



This Strange-Looking Tailless Craft Is the Latest Addition to Great Britain's Fleet of Fighting Planes

Radio 'Pilot' Guides Ship into Harbor in Fog



Essentials of Marchese Marconi's System for Guiding Ships into Harbor in Foggy Weather; Transmitted on a Wavelength of About Sixty Centimeters, Radio Signals and Sound Signals Are Sent Every Fifteen Seconds to Vessels Preparing to Make Port; Visual Signals Are Picked Up by Ship's Receiver and Ship's Course Is Indicated on Dial, as Shown at Top, Left, While a Microphone Picks Up Sound Signals to Be Carried to the Navigator by Headphones or Loud Speaker, as Illustrated at Top, Right; Stopwatch with Special Calibrations Shows Distance from Transmitting Beacon by Timing the Speed at Which the Signals Travel, the Speed of Radio Waves and That of Sound Being Known

Stamped Postcards Collected as Latest Hobby

Examples of Latest Hobby, Collection of Cards Bearing Pictures and Stamps of Certain Countries

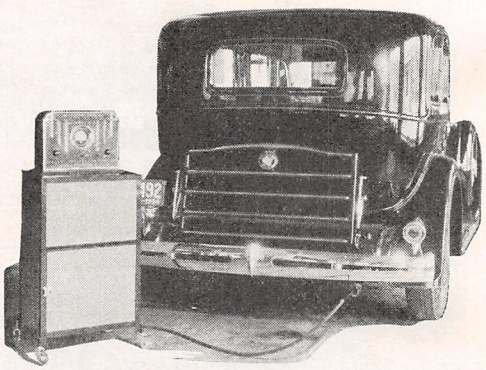
Picture postcards, bearing the stamp on the picture side, are being collected as a hobby in European countries. Thus, the card shows a view of the country, as well as the stamp, giving the stamp collector a new method of increasing his collection and adding interest to the work.

WIND IS ROBBING RANGE LANDS DUST CLOUDS PROVE

Dust clouds which swept over nearly half the United States this year originated largely on over-grazed, semi-arid lands plowed for wheat near the eastern side of the Rocky mountains, according to the forest service. Permanent damage to land as well as to current crops results from such dust clouds which are becoming increasingly common. Wind erosion on the plains is like water erosion in states farther east. Unless more conservative grazing is practiced and greater care is exercised in plowing extensive areas for wheat in areas subject to drought, desert conditions will begin, and once started, such lands cannot be reclaimed.

MOTOR EXHAUST GAS TESTER REVEALS POWER WASTE

Sources of power waste by the automobile engine are revealed quickly by a fuel combustion tester that analyzes the exhaust gas. Used after repairs have been made, it shows the owner the new efficiency with which carburetor, ignition system and other parts of the motor operate. Used before repairs are made, it shows the mechanic the source of trouble,



Test Equipment Takes Sample of Exhaust Gas and Analyzes Motor Troubles

saving time ordinarily spent in the trial-and-error method of locating the point of power waste. The tester is supplied with and without a portable cabinet stand.

PAA
WINGS
over the
SPANISH
MAIN
H. FOSTER

SPANISH Galleon (left) being overtaken by Pirate ship (right) in the Caribbean; typical of the olden days, this picture is reproduced from a painting.

TOP, bridge of clipper plane, showing pilot, co-pilot, radio operator and mechanic. Bottom, native of Nassau uses bow and arrow instead of rod and reel.

MAYAN pottery carrier on his way to market is frequently seen by air travelers in the Caribbean.

ONLY yesterday, it seems, an iron ring of wooden ships scoured the seas and chased gilded galleons for pieces of eight. Blackbeard, Captain Kidd, and Sir Henry Morgan, spread terror over that stretch of land and water known as the Spanish Main.

Today silver wings fly over the Spanish Main, where white sails once beat against the wind. Trading clippers charge across the skies like meteors, and alight on harbors where pirates once hid, awaiting their prey. Under the mouths of cannon, up to the walls of forts, and into the dens of pirates, the broad-winged ships of the Pan American fleet carry passengers, mail and cargoes of commerce.

Peace reigns over the Spanish Main. High-pooped frigates have given way to winged amphibians and swashbuckling buccaneers to sea-roving pilots. Lone travelers go where armed men once feared to tread.

That is the change which has come over the Spanish Main. The giant seaplanes and flying boats, the multi-motored amphibians have quickened the pulse of life in the Antilles. They bring letters one-

CHRISTOPHE'S Citadel overlooking hills of the island of Haiti, grim reminder of the olden days to passengers of the great clipper ship flashing by at high speed.

WATERFRONT at Nassau, Capital of the Bahamas, off the Florida coast, with sponge wharf and fishing boats in the foreground.

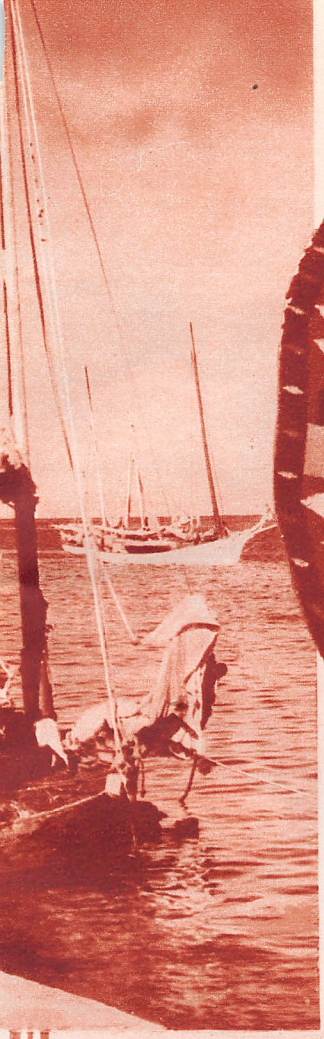
day old from cities that formerly were separated by a week or two of travel.

Everywhere the traveler cruising over the Spanish Main sees reminders of the buccaneers. Everywhere one is directed to secret burials of pirate gold. Hardly a league of land can be found between Barranquilla and the Ten Thousand Islands where tradition does not have it that Captain Kidd buried his treasure. Strange enough, the only place where Captain Kidd's treasure has been found is not in the Spanish Main but on Gardiner's Island, in Long Island Sound. Port Royal, Porto Bello, Maracaibo, Puerto Principe, Tortuga—great names in a pirate's geography—are now reached by fleet-winged aircraft flying over the air bridge from the States.

What would Sir Henry Morgan and his freebooters think of those streamlined greyhounds of the sky? Seventeen-ton clipper ships roaring down the Main at two and one-half miles per minute! And behind them an armada of 100 ships criss-crossing the Caribbean and spinning an airway web over 10,000 miles of open water!

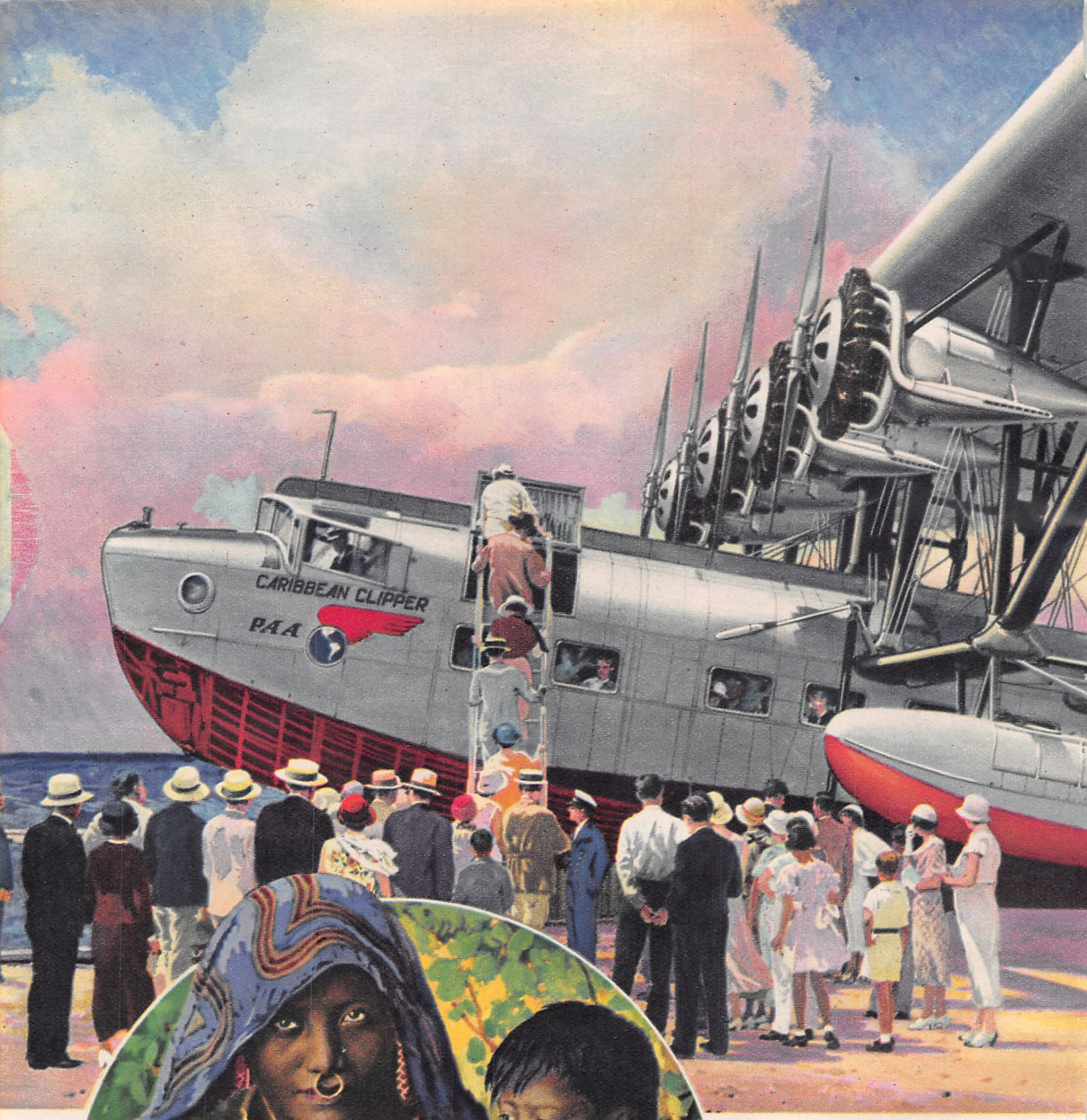
In the olden days, it took weeks to cross the Main; today it is a matter of hours. Passengers recline in soft velvet, sip cold drinks, and look down upon the turquoise sea and palm-fringed islands.

But never for a minute are they out of touch with civilization. The radio man sits at his post relaying orders to pilots



ABOVE, Mexican senorita with beautiful native-woven rug in the background.

BELOW, native women carrying huge baskets of coal to refuel ship in the West Indies.



TOP, giant silver-winged clipper ship taking on passengers and mail at one of the ports of call where pirate ships once flaunted the "Jolly Roger." Left, native woman and child of the type frequently glimpsed by the clipper's passengers as they visit sections of Caribbean towns.

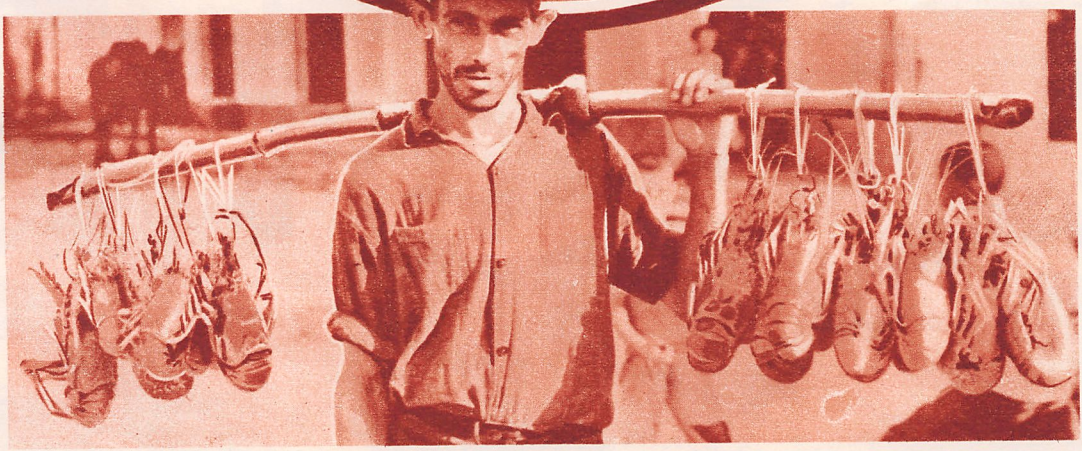
RIGHT, fiesta time in Old Mexico brings the brave caballero to woo his senorita beneath a soft southern moon; a scene beside the waters of the Caribbean.

who guide their ships with a precision that would make a pirate blush with envy.

In days of yore, the pirates swore allegiance to their leaders in oaths signed with blood. Their code was, "No prey, no pay!" And just as the lives of modern employes are insured, the pirate chiefs insured the lives and limbs of their men. Six hundred pieces of eight (a piece of eight was worth one American dollar), for loss of a right arm; five hundred pieces of eight for a left arm; one hundred pieces of eight for an eye, and one thousand for total disability or death. $1000 in those days was equal to more than $20,000 today.

Life and limb are safer on the Spanish Main than they have ever been. Millions of passengers have been carried and hundreds of millions of miles have been flown, but not one passenger on the Pan American lines has met with a major disaster. This

TOP, interior of clipper plane, showing passengers playing bridge, while girl traveler reads; through the doorway, the co-pilot chats with passengers. Bottom, water boy of Managua stops to be photographed as he plies his trade, a common sight in many Caribbean countries.



TOP, sailing majestically through silver-tinted clouds, the great clipper roars southward above a land made more romantic by countless legends of bold pirates. Bottom, fisherman offers his wares in seaport town in Cuba.

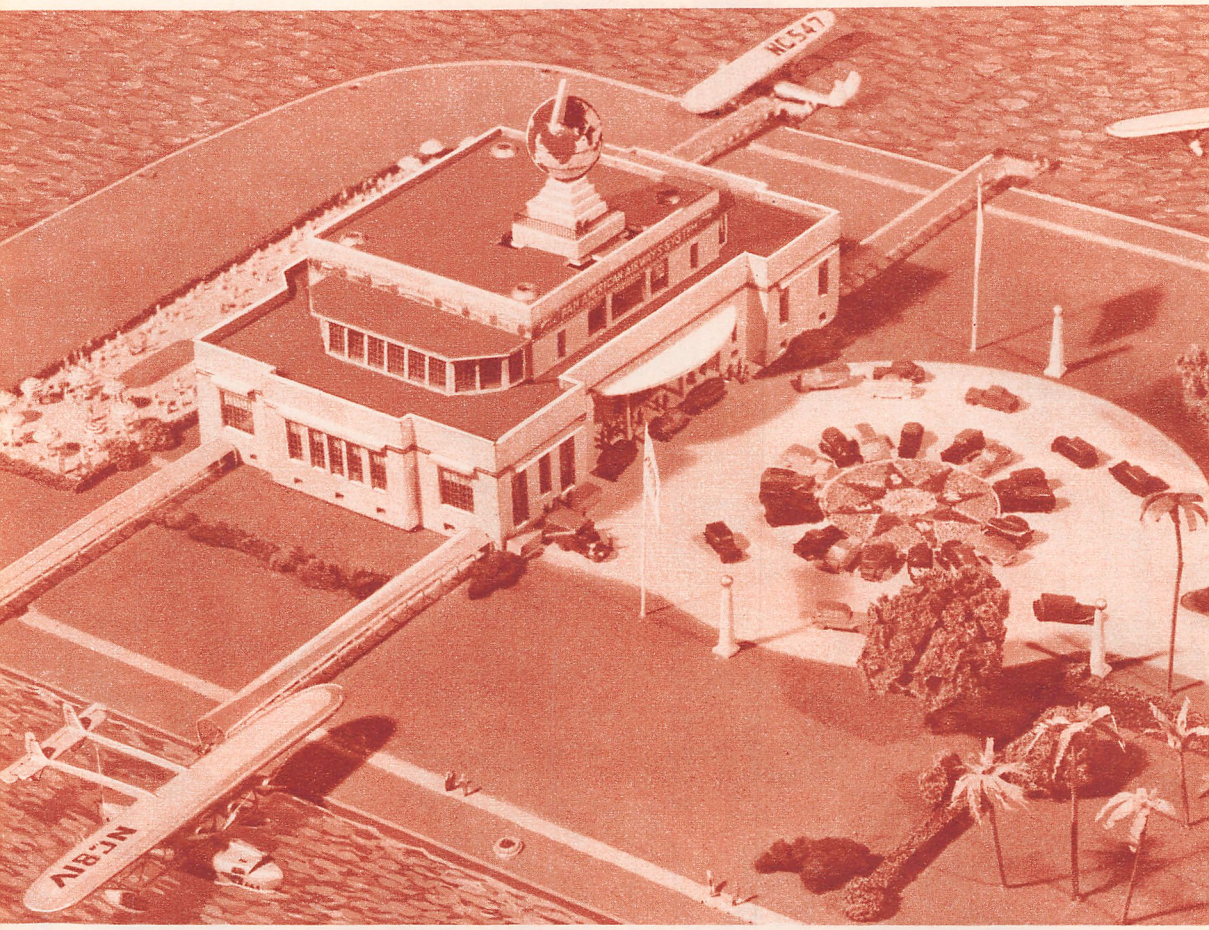
record is maintained under the strictest discipline any non-military organization has ever set up.

Pilots are trained not only in mechanics and aerodynamics, but in the more delicate matter of responsibility.

Pan American has developed 147 airports and 72 ground radio stations, while as many private weather stations maintain contact with the air liners. While covering jungles, mountains, deserts, and the longest over-water stretches on any airway, Pan American ships have maintained an accuracy of 99.68 per cent in their schedules. From being one of the most inaccessible regions in the Western Hemisphere, the scattered islands on the Main have become among the most accessible. And while in former days a

LEFT, Guatemalan woman carries child in arms while balancing heavy basket. Below, famous Moro Castle at Havana, Cuba.

WATER carriers of Barranquilla, Colombia, in South America, gather to fill their casks and to gossip before starting their rounds of the town.



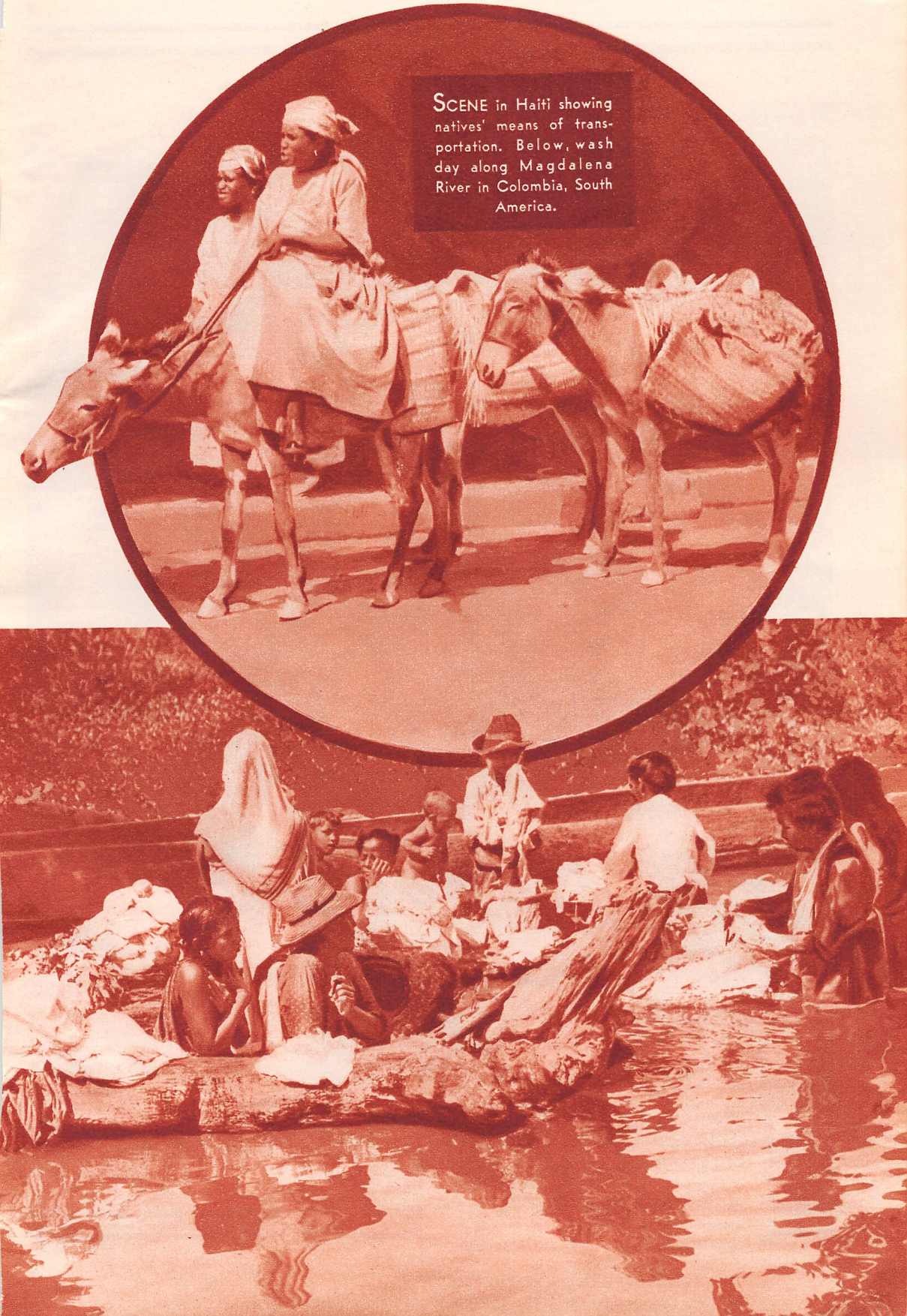
CLIPPER ships, one of which is shown at lower left, rise from this airport, one of the finest in the world, at Miami, Fla.

cruise through the West Indies was fraught with danger from that bloody fraternity known as the "Brethren of the Main," today it is among the safest places to visit.

On Seven League Air Boots, you can now cover by air the routes used by the Spanish galleons and their naval convoys in carrying treasure from Cartagena in the New World to Cadiz, Spain. Scarcely a ship ever left port that she was not attacked by the "Brethren of the Main," who ruled the Caribbean for more than a century.

At Port Royal, Jamaiça, where today the wings of clipper ships are a common sight, you can still see the moats and drawbridges of Old Fort Charles, the pirate stronghold. Port Royal, in the heyday of pirateering, was the wickedest place under the sun. Part of the town now lies under the sea, submerged by a terrible earthquake. Many a bold plot was hatched inside the walls of Port Royal. Here Sir Henry Morgan ruled with an iron fist. On the ramparts of Fort Charles, Admiral Horatio Nelson paced up and down, awaiting an attack from the French fleet, which never came. The once-busy waterfront is almost deserted, while Kingston, across the harbor, prospers.

Shot-riddled vessels carrying the Jolly Roger are gone; the proud figureheads of bristling frigates are no more. But on any morning or evening, with the rising and setting sun, you can see a great silver-winged bird dip into the blue waters as it skims past the abandoned nest of saber-slashing pirates.



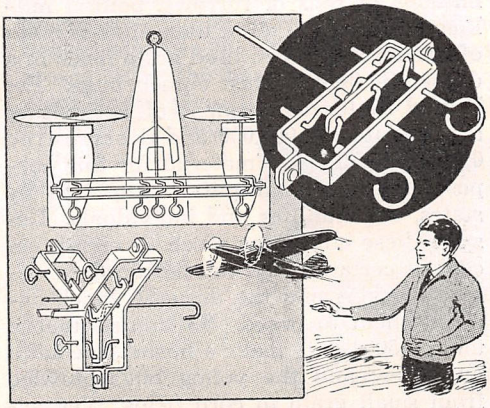
SCENE in Haiti showing natives' means of transportation. Below, wash day along Magdalena River in Colombia, South America.

HUMAN "Beasts of Burden" are common in countries visited by the clipper ships; here is a water vender, typical of Mexico's mountain cities, plodding along with his huge water container at Guanajuato, Mexico.

[partial page]

MODEL PLANE TRANSMISSION GIVES MORE POWER

Gearless transmissions are being offered as a means of improving the performance of model aircraft. The transmissions are multiple band motors, using two or more thin strands of rubber instead of one thick strand. The result is more power with twice the endurance of a direct drive. The prime mover is made of duralumin and music wire, with two or more separate strands of rubber on the two or more separate crankshafts. It is easily glued to the motor stick or to the built-up fuselage if no motor stick is used. The midget model transmission weighs one-fiftieth of an ounce, while a larger transmission designed to propel models of multi-motored airplanes weighs one-quarter ounce. This transmission is used in models with twenty-four-inch wing spread.



Circle, Transmission for Model Planes; Left, How Transmission Is Installed in Multi-Motored Craft

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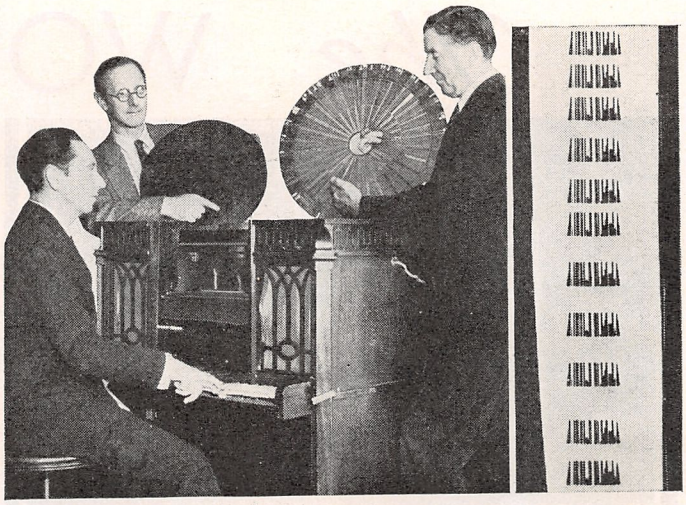
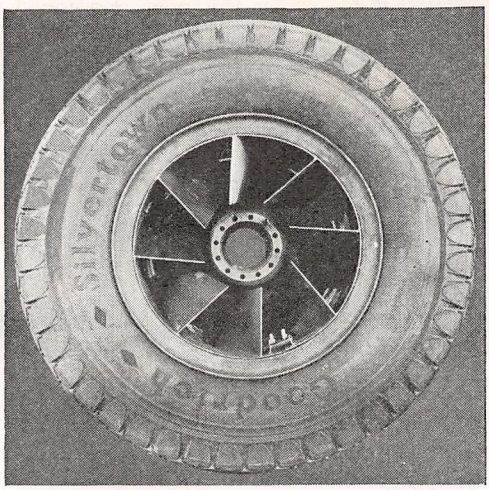
laid. The holes should be flared to this line and kept dusted. Avoiding the odor of creosote—which must be renewed daily the first week, then every two or three days—the invading bugs tumble into the posthole traps and are destroyed.



Homemade Electric-Eye Organ and the Revolving Disks and the Film Sound Track of Tones Used in Playing It

FAN INSIDE WHEEL COOLS TRUCK TIRE AND BRAKE DRUM

Successful tests of a method of lowering brake drum and rim temperatures for trucks and buses have been conducted by the B. F. Goodrich company. Invented by the Rogers Brothers corporation, the method consists of a fan built inside the wheel to dissipate heat on dual-tired vehicles. In tests, the fan lowered temperatures about fifty per cent, indicating that its use in normal service would prolong tire and brake life.



Fan Built Inside Auto Wheel to Lower Tire and Brake Drum Temperatures of Trucks and Buses

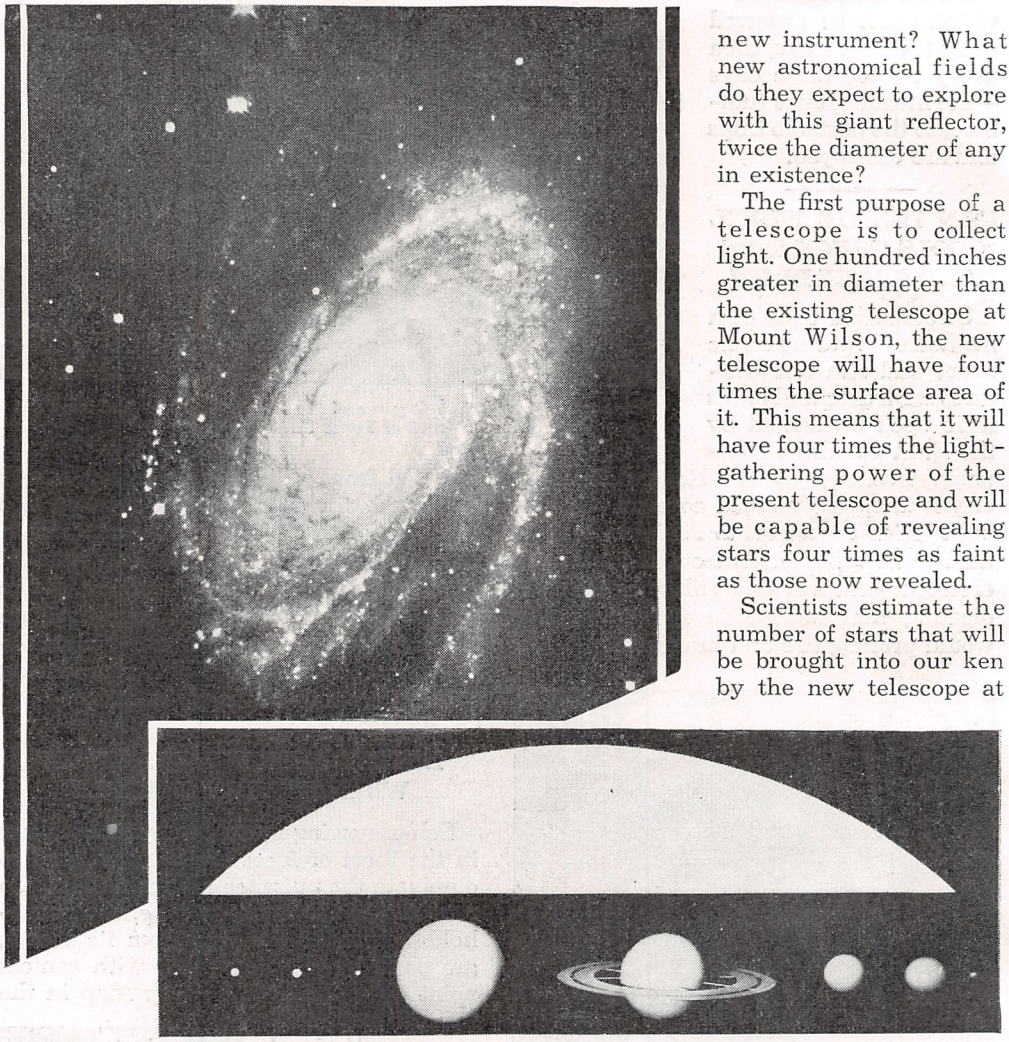
HOMEMADE PHOTO-CELL ORGAN HAS FINEST TONES

Music with the tonal quality of that produced by famous musicians can be played by any pianist on a homemade organ constructed from a dishwasher motor, an old keyboard, tin cans, a loud speaker and other "gadgets." The organ contains a photo-electric cell on which a beam of light shines through revolving disks. A film sound track of tones rephotographed on the disks is converted into sound when the beam reaches the photo-cell, reproducing the original tone of the virtuoso.

LATEST FUSE RENEWS ITSELF WHEN SHAKEN SHARPLY

Self-renewing mercury circuit breakers in the form of fuses are being offered to eliminate the nuisance of blown fuses. To recondition the mercury type, the householder removes the fuse from its socket, grasps it by the head and, with contact point down, gives it a sharp snap in the manner of resetting a clinical thermometer. Under overloads or dead shorts, the mercury used as the fusible element volatilizes and expels itself into an expansion chamber. Snapping it causes the mercury to return to contact position. One fuse, blown 1,000 times in test, is still in operation.

The WORLD'S



Above, Our Universe as It Might Appear from Distant Star; Below, Model of Segment of Sun in Scale with Planets; Earth Is Third from Left, the Dot Beside It Indicating the Moon

RECENTLY science took a peek at its most famous baby. It lifted the cover, so to speak, and looked in on the 200-inch telescopic "eye" cast last March at Corning, N. Y. The baby was doing well. Now it remains only for this marvelous scientific achievement to finish cooling before it is mounted at Mount Wilson observatory, California, to become the world's largest reflecting telescope.

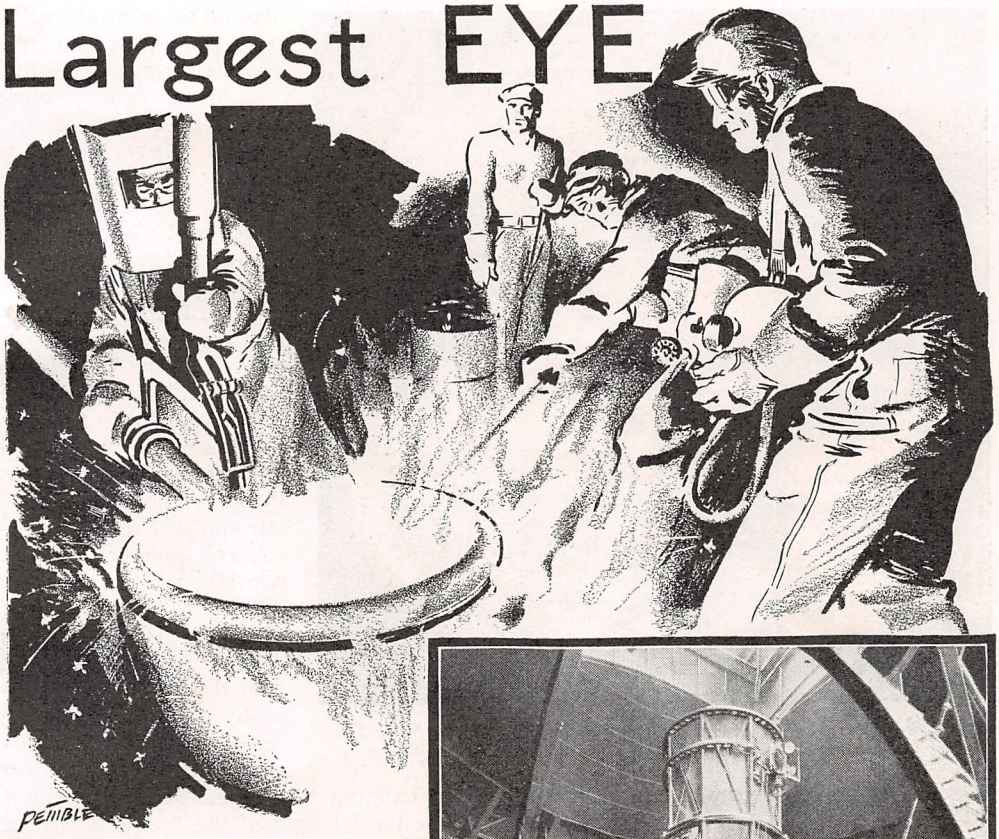
What do scientists expect to see with this new instrument? What new astronomical fields do they expect to explore with this giant reflector, twice the diameter of any in existence?

The first purpose of a telescope is to collect light. One hundred inches greater in diameter than the existing telescope at Mount Wilson, the new telescope will have four times the surface area of it. This means that it will have four times the light-gathering power of the present telescope and will be capable of revealing stars four times as faint as those now revealed.

Scientists estimate the number of stars that will be brought into our ken by the new telescope at 1,500,000,000—about as many as there are people on the earth. Even this number may be exceeded for the estimate takes no account of the "cumulative effect of the photographic plate"—its ability to record more stars than can be seen with the telescope. Only about 6,000 stars can be seen with the naked eye.

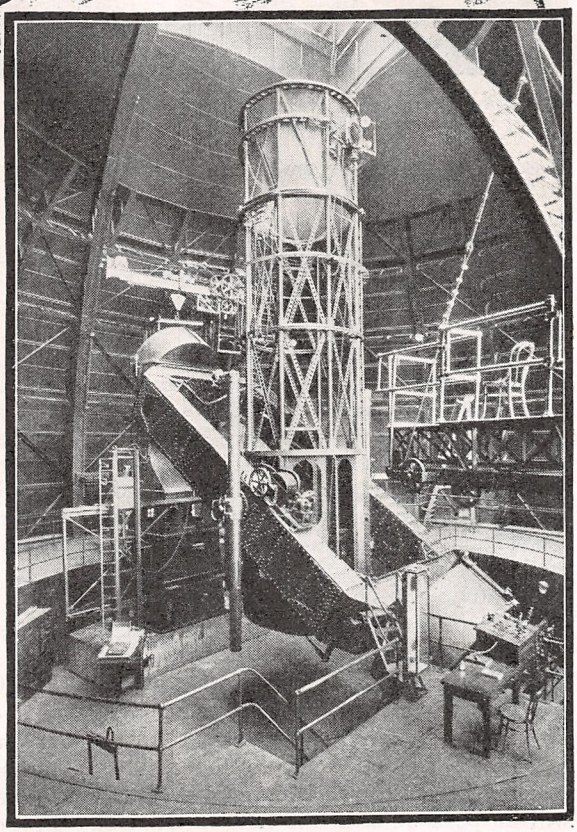
Magnification of heavenly bodies is something apart from picking up light thrown off by them. In the field the new

Largest EYE

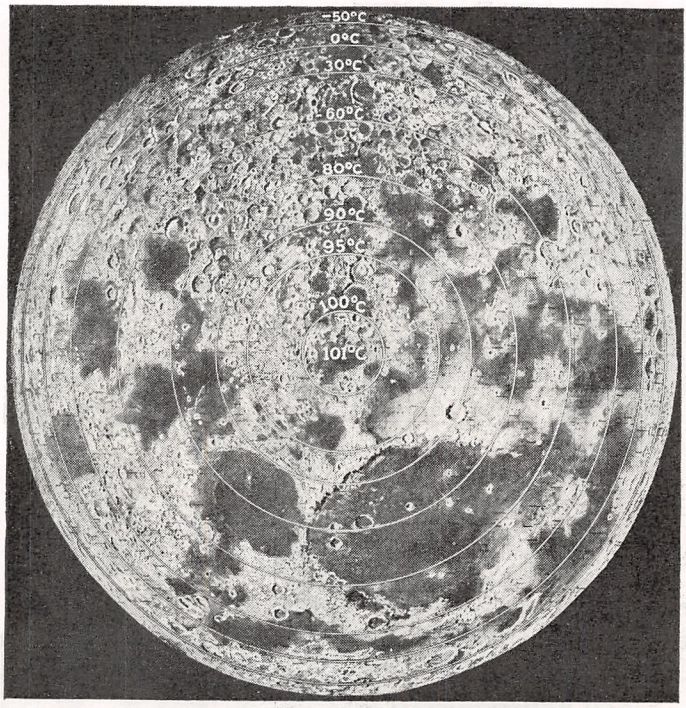


telescope will have its function also. Though not so important as gathering faint starlight, the bringing of the moon and other celestial spheres closer to the earth will be of incalculable value to science. In the case of the moon, that body will be brought within twenty-four miles of the earth. This is startlingly close. Tall buildings, if such existed on that body, would be easily discernible and objects separated by no more than thirty feet would be distinguishable.

Mountains are known to exist on the moon. Great craters or pits may be seen, and have been photographed. Even the shadows cast by the moon mountains stand revealed on photographic plates already made. Through previous studies scientists know that the moon is not inhabited—that it is a dead or burned-out planet. It pos-



Above, Bowl of Molten Glass Ready for Pouring into Mold for "Eye"; Below, 100-Inch Telescope at Mt. Wilson



Composite Photograph of Moon Showing Its Craters; Circles Show Temperatures as It Faces Sun; Temperatures Are Lower at Edges

sesses no atmosphere, no water, no vegetation or life—at least as we know it. But scientists would like to know more about the moon's craters, its mountains and, particularly, its "soil." More knowledge about the moon might help solve the question, "Where did the moon come from?" That the new telescope will bring this body, 240,000 miles away, within twenty-four miles of us is a marvelous achievement.

The new telescope also may help solve the question as to whether our universe is "expanding" or not. Are the nebulæ—the vast star worlds of space—receding from the earth at tremendous speeds? Science's method of checking up on these nebulæ is by photography, but hitherto they have moved too fast for their reddened light to be accurately photographed. But the 200-inch telescope with its red sensitive photo-electric cell will "spot" them on camera plates regardless of their speed.

The study of our solar system will be greatly enhanced by the new telescope. It will be possible with the new instrument to photograph the faint satellites of some of the planets whirling along with us around the sun. Mars, the most intriguing of all the planets as regards life, will be brought so close that a great city, if one exists there, could be dimly outlined.

In the case of comets, which cut through the heavens sometimes very close to us, it will be possible to follow them further into space than heretofore. More knowledge thus should be gained of their behavior in the vast reaches of the void where they speed eternally. Pluto, at the outpost of our sun world, latest discovered member of our family, will be brought within 370,000 miles of the earth. Physically it is distant 3,700,000,000 miles.

In the field of photography the new telescopic camera will take photographs ten times faster than existing telescopes. This is because of the focal length of the "camera" to the lens—fifty-five feet by 200 inches. In existing telescopes the ratio is not less than one to five or one to six. The secret of this photographic speed is more light. The 200-inch lens will permit almost instantaneous exposures. The faster the camera photographs, the less blurring, twinkling and shimmering of the atmosphere on the photographic plate. This means clearer photographs of the stars and nebulæ.

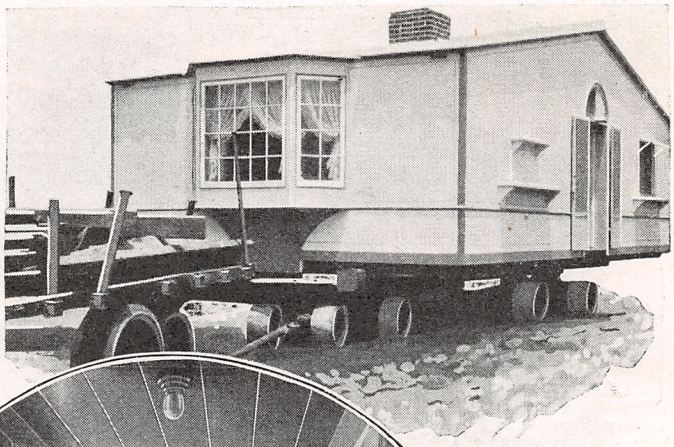
Planets of other star-suns, like ours, will not be visible. All that can be gleaned of them will be the knowledge gathered from the light coming to us from them and their central sun. The nearest of these sun-stars, outside our own solar system, is four and one-half light years away—27,000,000,000,000 miles.

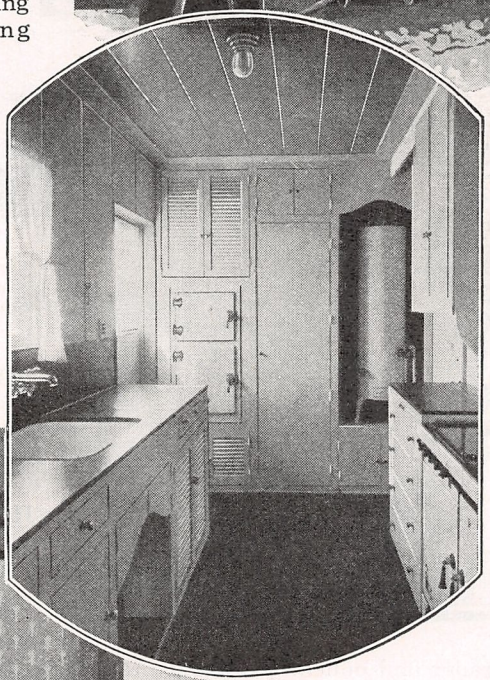
Does the new telescope mark the limit of man's ability to penetrate the void in his search for starry knowledge? From the standpoint of size this is largely believed to be true. There was grave doubt as to whether this mirror would come

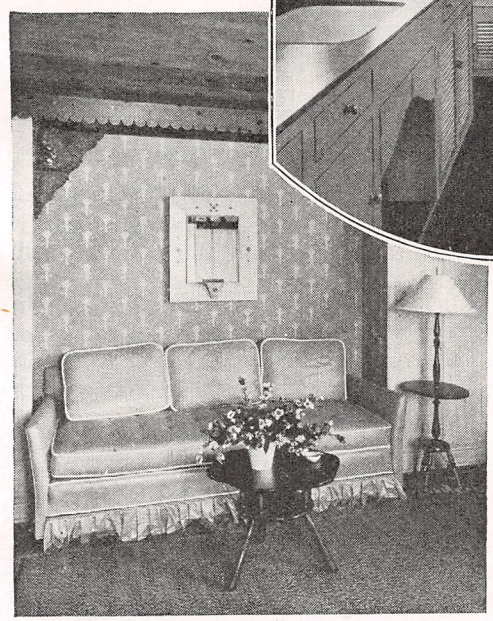
(Continued to page 130A)

Factory-Built Home Hauled to Site by Truck

Factory-built homes, ready to live in when they leave the builder, are being constructed in Los Angeles. They are moved by truck to any desired location and set in place in a few hours. These houses are built in sections and a small cottage may be ordered and additional rooms can be added later, the planning and construction being such that the extra room or rooms, already built, can be sent to the house by truck and quickly attached. The homes are said to be termite-proof, storm-proof and resistant to earthquakes. Walls are six inches thick throughout, air-dried redwood







Hauling a Factory-Built Cottage to Its Future Site, and Views of Kitchen and Living Room

is used for exterior walls and the chimney is reinforced with steel. There are many designs and combinations from which to choose, ranging all the way from a cottage with one bedroom to a house with five sleeping rooms. Interior walls are of redwood with the exception of the living room which is paneled in knotty pine. The roof can be finished with tile, shingles or a form of planking. Quality paint and standard hardware and plumbing fixtures are used and factory production reduces the cost of such homes as compared with similar houses constructed in the usual way.

PLANES LOSE THEIR BEARINGS OVER BIG IRON DEPOSITS

Airplanes flying over Minas Geraes, Brazil, frequently are thrown off their course on account of large iron deposits in that area. Compasses cannot be relied upon. Brazilian planes in recent practice maneuvers were unable to proceed when the pilots lost their bearings.

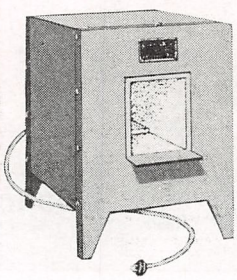
Traveling Movie Theater Is Housed in Trailer

Exterior and Interior of Movie Theater on Wheels; It Is Fully Equipped and Seats Thirty-Two Persons

Housed in a semi-trailer and pulled by a two-ton truck, a traveling movie theater is operated by one company to advertise women's fashions. Entrance to the talking picture theater on wheels is at the front where a door folds upward to become a canopy. Double doors at the rear are operated synchronously with steps. Aluminum panels are used in the streamlined body. There are sixteen double seats, each pair being somewhat higher than the ones in front. The interior lighting consists of tubular lamps running lengthwise overhead and illuminated masques along the walls. The control room occupies the space between the stage and the nose of the body and in it are the projector and talking machine, a generator and a switchboard from which the lights are controlled.

HOME ELECTRIC KILN MAKES POTTERY AT LOW COST

Pottery making in the home or small shop is made practical through the use of a small electric kiln that operates at low cost. Plugged into a standard light socket, it fires up to 2,000 degrees Fahrenheit. The cost for one and one-half hours of baking is about four cents. The firing chamber is three and one-half inches by three and one-half by four. Before this small kiln was devised, the student had to take his pottery to a commercial kiln for baking.

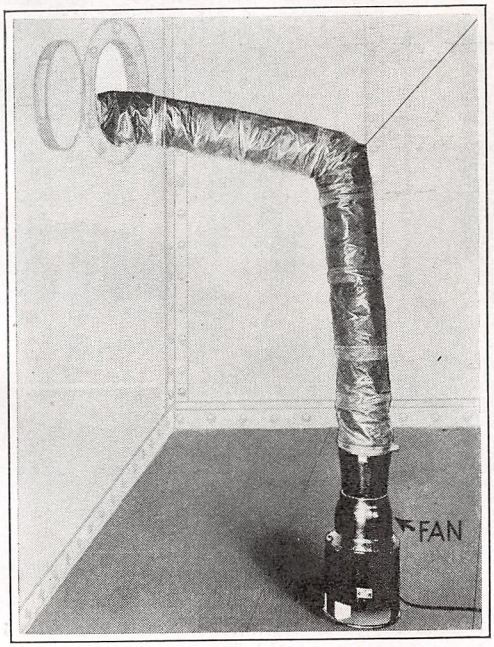


CHISEL WITH ELECTRIC MOTOR REMOVES HARD PUTTY

Hard putty on steel window frames can be removed easily and quickly by using a new motor-driven chisel. The electric motor, at one end of a flexible three-foot shaft, is strapped to the side of the operator to relieve his hands of unnecessary weight. At the other end of the shaft is a hammer cylinder into which the chisel is inserted. The machine also may be used as an electric hand polishing device, for chiseling hard materials and for special cleaning operations.

PORTABLE VENTILATOR UNIT REMOVES FUMES QUICKLY

Welding fumes and foul air can be removed quickly from enclosed spaces with a portable ventilator developed recently. The unit is compact and can be lowered through an opening with a fourteen-inch diameter. The weight, including electric motor, is only eighty pounds, so that it may be set up and operated by one man. Fumes and foul air are removed at the rate of 1,500 cubic feet per minute.



This Unit, with Arrow Pointing to Location of Fan, Removes Fumes at Rapid Rate

Simple Hose Attachment for Watering a Second-Floor Window Box from the Ground

TOOL FOR "AERIAL GARDENING" WATERS SECOND FLOOR BOX

Caring for a window garden on the second floor in the absence of the owners was the problem solved by their neighbor. By rigging up a device to hold the hose at the correct height, the substitute gardener was able to water the plants in the box several feet above his head. This eliminated the necessity of entering the home to reach the box.

¶Names and addresses of manufacturers and dealers in articles described, and any other details in our possession, will be furnished by our Bureau of Information upon request, accompanied by postage.

From THICK *to* THIN *in*

Left, "Armored" Wood, Showing How a Thin Sheet of Aluminum Covers Piece of Plywood

Right, Wood Mosaics, Depicting the Modern Industrial Plant, Is Made from Plywood

materials are pre-tested carefully. The result is that there are rigid airplane wings built of materials scarcely thicker than egg shells, streamlined trains built of thin metal sheets, skyscrapers standing on steel matchsticks, building fronts of transparent glass and very thin partitions between rooms.

The plywood industry is the father of the fashion of going from thick to thin. Two recent discoveries in the fabrication of ply materials promise to cause many things to go from a traditional thickness to an uncommon thinness.

EVERYTHING is going from thick to thin. The difference between old and new construction, whether it be furniture or bridges, is mainly in the amount of waste. Under old methods materials were wasted because so little was known about their nature and characteristics. Today,

The most important development is the process for manufacturing plywood with phenolic resins as a binder instead of glue. The custom of gluing thin sheets of wood veneer into a panel prevented the use of

BUILDING

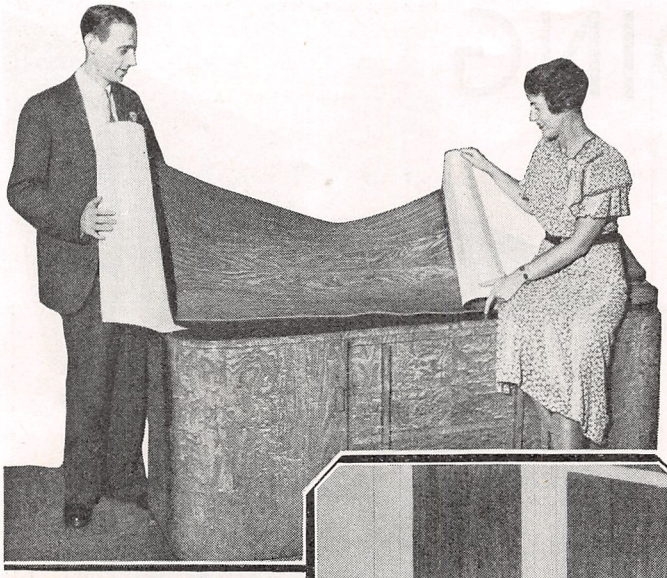
plywood in damp or exposed places. Phenolic resin is one of the chemical plastic products and until recently its ability to weld wood veneer was not suspected. Since no water is involved, the phenolic resin can scarcely be called a glue. But it does have the capacity, when sandwiched between two sheets of veneer and subjected to heat and pressure, to weld the plies into waterproof, germ-proof, weather-proof panels. While under pressure, the resin penetrates the wood fibers to a depth of one-sixteenth of an inch on both sides, forming a bond of great strength.

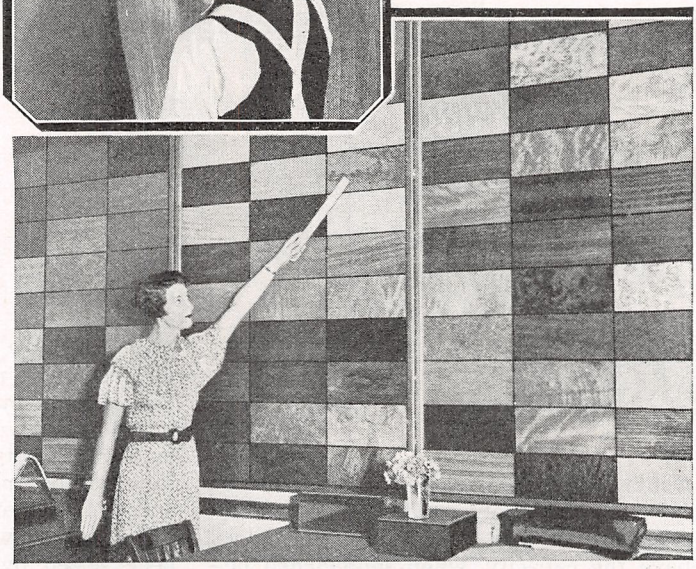
Below, Room in This Modern Home Is Papered with Wooden Wallpaper, a Boon to Builders

Above, the Young Lady's Hat, Belt, Purse and Gloves Are Made of Wood; Special Processes Convert Wood into Materials That May Be Used for Many Unusual Purposes

As the first weather-proof panel ever made, the new welded plywood finds extensive use in modern construction work. You can now build a house with a plywood exterior that will be as weather-resisting as any other type of wood construction. You can use plywood on garages, barns and damp cellars, without the fear that it will check or warp. Welded plywood has been seized by small boat builders as a surface material which combines unusual strength with thinness.

In order to add even greater strength





Top, Wooden Wallpaper with Cloth Backing; Center, Applying Wooden Wallpaper; Bottom, Foreign and Domestic Woods Used in Wooden Wallpaper and Plywood

and durability to welded wood, manufacturers recently conceived the idea of covering it with thin sheets of metal. In this wise they have created what might be described as "armored" plywood, with the strength of metal and the flexibility of wood. The idea was of such importance that builders of Burlington's streamlined "Zephyr" adopted it for all cars of the train. In this instance the welded wood is covered with stainless steel and gives the appearance of unusual strength. The unexposed side of the "armor" is covered with a sheet of electrolytic copper, which is welded to the stainless steel. Thus the core of the "Zephyr's" armor, three-ply basswood, is forever sealed against the air. It is now possible to glue metal to wood in such a way that the differences in expansion and contraction of the metal do not affect the strength of the bond. A special elastic glue has made possible the use of plywood as wing material for airplanes. A thin duralumin sheet covers the plywood and renders the wing impervious to the weather. In addition to this many common metals can be made to cover plywood panels, including copper, lead, silver, duralumin, steel, iron, chromium, and many alloys rolled into thin sheets.

Another recent advance is the use of phenol resin to give a high polish to fine woods. This polish gives depth to the grain and gives the wood surface a rich and iridescent luster which is hard and never dulls. When surfaced with such a polish, a thin ply of expensive wood like mahogany can be

welded to cheaper board and used for table tops and other articles in the home.

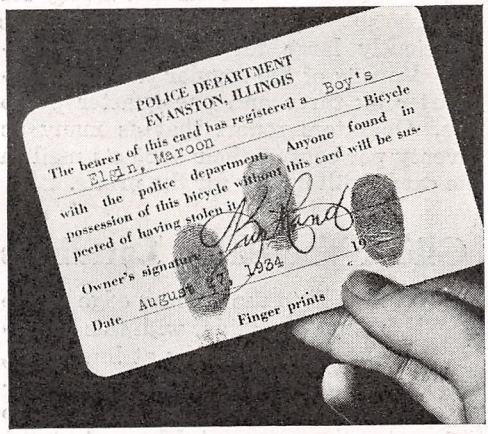
Designs on cloth or heavy paper can also be covered with the phenol polish, which makes them resistant to wear.

In the building industry plywood is now displacing thick boards in the construction of concrete forms. Because it is highly water-resistant, one piece can be used from seven to ten times, besides saving from forty to seventy-five per cent of carpentry labor.

The possible uses of plywood in home building are numerous. Outside and inside walls, floor bases and coverings, ceilings, panels, cabinets, doors, and dozens of other articles are now available to home builders. Manufacturers estimate that the average home has from 6,000 to 8,000 square feet of space where plywood might be used advantageously.

"FINGERPRINTING" OF BICYCLES GUARDS AGAINST THEFT

Bicycle owners of Evanston, Ill., are being offered protection against theft by a "fingerprinting" system. Bicycles carried to the police station are registered, the frame number being recorded. If the bicycle has no frame number, a registration number is stamped upon the frame by the police department. Then the owner is fingerprinted and issued a license card bearing the name, address and physical description, as well as details of the bicycle's construction.



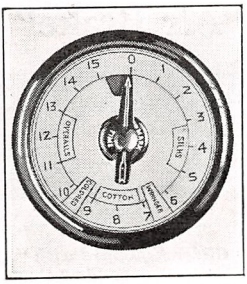
Registration Card Bearing Owner's Fingerprints Helps to Reduce Bicycle Thefts

Radium Dust Speeds Up Growth of Plant (Left) Compared to Normal Growth, Shown at Right

RADIUM AIDS PLANT GROWTH BY NOURISHING ROOTS

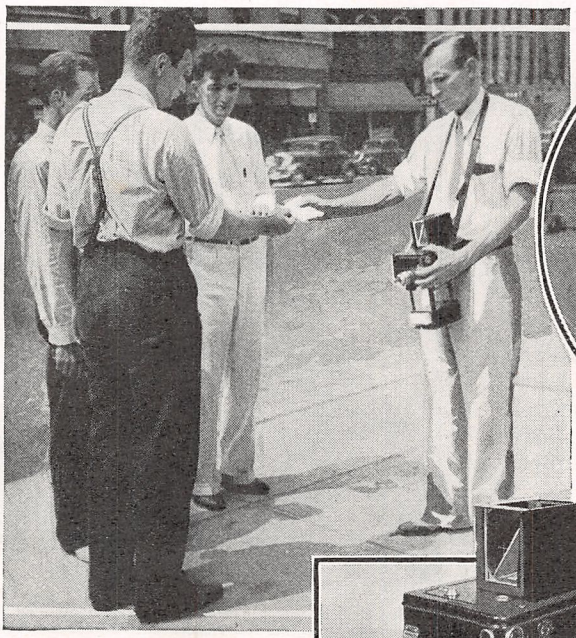
Radium dust, added to the soil, will speed up growth of plants. Dr. Luther Gable has found that this method may be used in growing expensive greenhouse flowers. Unusual growth resulted from a three-weeks' experiment in which radium dust caused intense root formation.

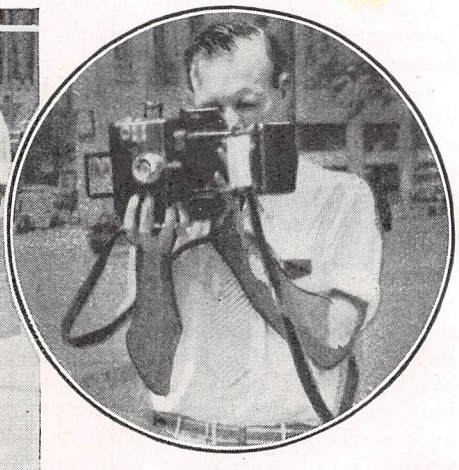
"MARK TIME" WASHER SWITCH PROTECTS CLOTHES



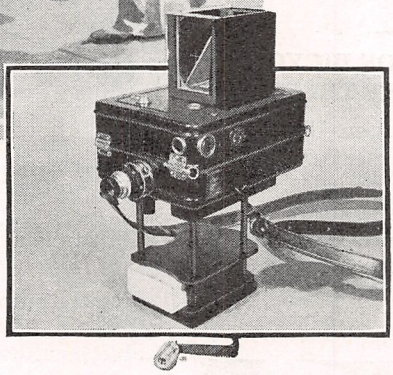
Washing machines may be equipped with a "mark time" switch that permits the washer to operate any predetermined number of minutes. The switch protects clothes by cutting off the machine when the washing period is finished. A pointer can be set for correct washing of popular fabrics.

Making Movie Snaps Becomes Real Business



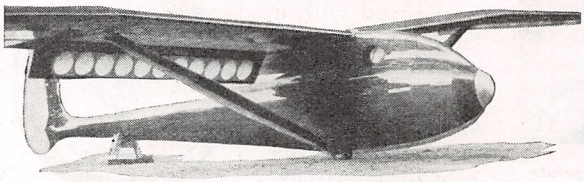


Making Unposed Snapshots with This Standard Newsreel Camera Earns a Living for This Photographer



Unposed snapshots, made with a standard newsreel camera, are the basis of a new business that may be carried on wherever crowds gather. As a person walks along, the movie camera man snaps three views quickly, then hands his subject a card. On the card is a place for inserting a coin. A number identifies the snapshots for the photographer. Mailed to the photographer with the coin, the card brings in reply the three views to the subject. Some of these movie snapshot operators use a DeVry newsreel camera using thirty-five-millimeter film, with an attachment for taking three frames of the subject. A shoulder strap holds the camera steady for shooting. The film is sufficiently large for making clear enlarged prints of the regular two and one-quarter by three and one-quarter photo size. Operators report that as many as seventy per cent of their subjects mail in the cards with money for the prints.

"Air Brake" to Slow Down Glider for Safer Landings



Glider Equipped with "Air Brake" on Trailing Edge of Wing to Slow Down Craft for Safer Landing

Sailplanes and other craft of the motorless or glider type can be landed more safely by attachment of a flap or "air brake" to the trailing edge of the wing. One glider with this equipment lands easily at low speed, the flap retarding the speed considerably to bring the craft to earth more quickly and at the landing field selected.

¶American-operated air lines flew 796,950 miles per accident in the first six months of 1934 according to figures of the department of commerce.

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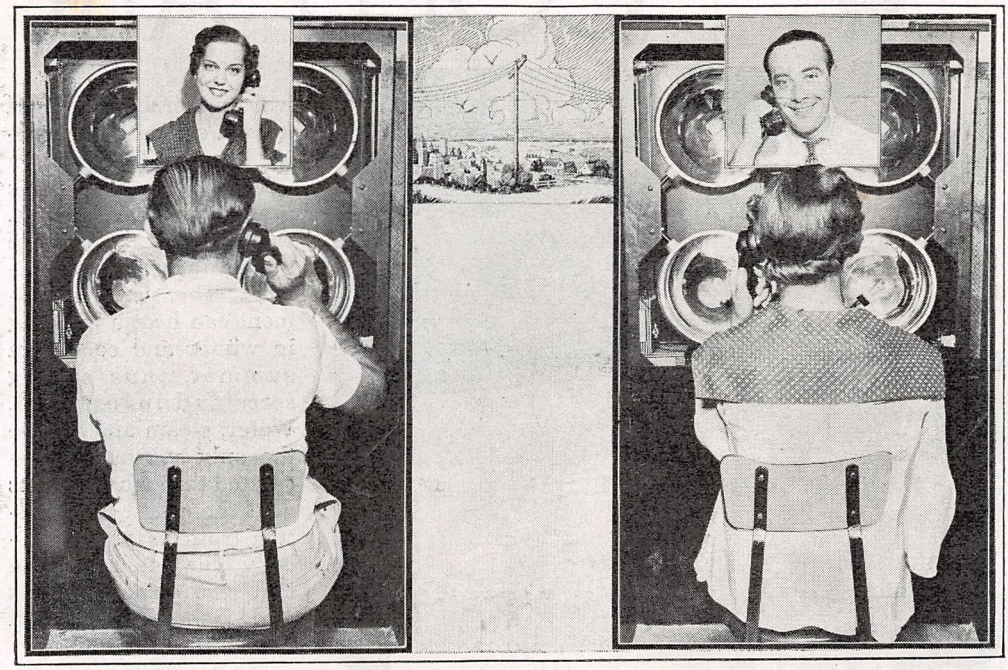
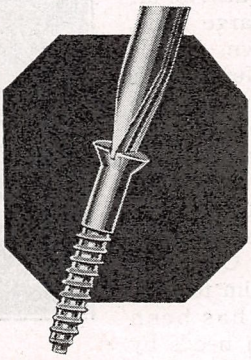
Phone Users See Each Other by Television



Two Telephone Users Sitting Before Instruments Equipped with Television Transmitters and Receivers; Small Photos above Head of Each Illustrate How They See Each Other through Medium of Telephone

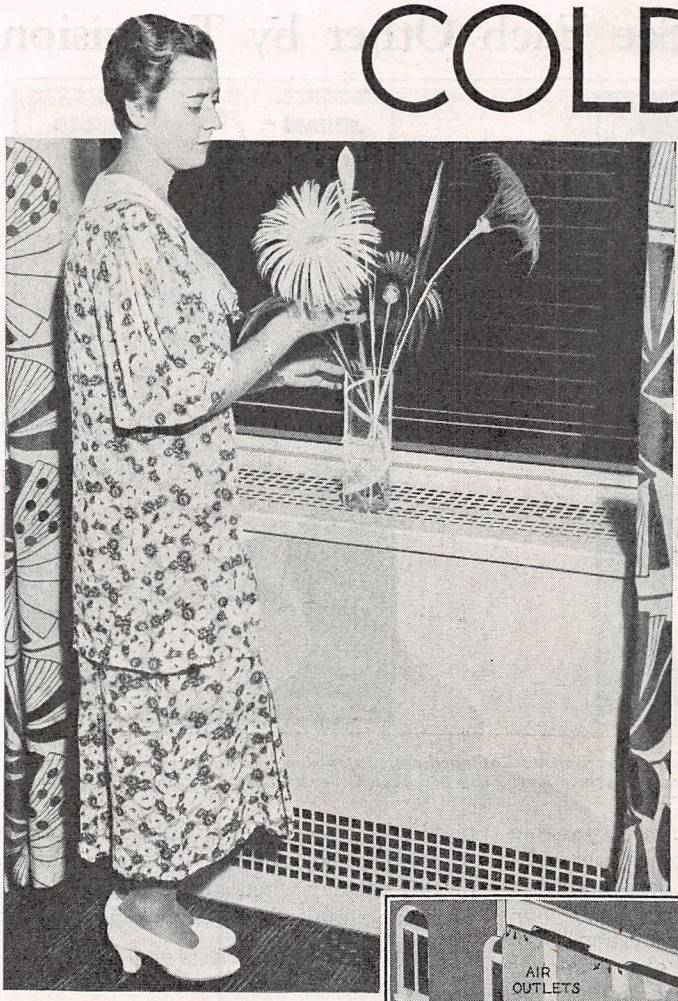
Two-way television, making it possible for users of the telephone to see each other, is accomplished in a demonstration system, devised and constructed by pioneering engineers in the television field. The system incorporates a glow lamp of an advanced type that assures long service and improved pickup of images, as well as perfected synchronization between the sending and receiving scanning disks. The glow lamp is a delicately constructed tube containing a highly specialized filament. It is in the experimental stage. The scanning disks are used for transmission and reception of the image, a device that presents the lines of the face or figure through the use of rapid motion set up by electrical impulse. In the demonstration system, only one scanning aperture is used for both sending and receiving, while radio television uses two apertures. Through the one aperture in the telephone setup, the image of the telephone user is picked up and transmitted to the listener at the same time the listener's image is picked up and flashed to a screen in the talker's booth. Engineers of the Television Exhibits corporation, which operates the system, predict the day when such equipment may be made standard for every telephone at reasonable cost.

SCREWDRIVER HOLDS SCREW BY ITS SLOTTED HEAD



Easy insertion of screws in close places is accomplished by a screwdriver that grips the slot in screw heads. The tool is equipped with a knurled slide that is pushed downward to cause the blade to grip the slot of the screw. Pushing the slide upward releases the screw. Corrugations on the blade and the gripping lever insure positive hold on the screw head.

COLD AIR



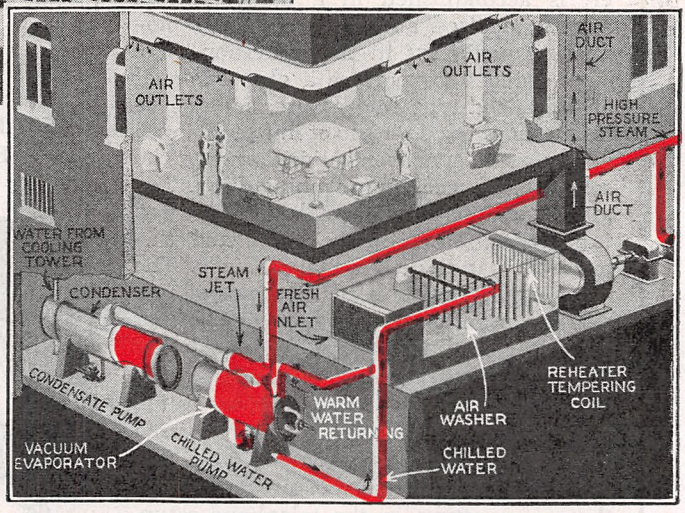
"STEAM chilling," the latest paradox in the quest for air conditioning on a large scale, has come into its own. Installations in some of New York's skyscrapers makes it possible to turn from winter's "steam heat," to summer's "steam chill" about as quick as you can turn the handle of a faucet.

An old principle, first observed by William Cullen in 1755, and used by him to produce ice artificially has been adapted to modern needs by modern engineers. Now known as the "steam-jet" or "steam-vacuum" system of refrigeration, it is claimed by equipment manufacturers that it is the most economical and practical of all known systems for cooling large buildings.

The only moving parts are two ordinary pumps. All the other fixtures are stationary and permanent. The same equipment can heat a building in winter and cool it in summer, thus saving space and investment. Water, steam and air are the only substances circulated through the ducts and chambers. Lubrication troubles are practically eliminated, because there are no moving parts aside from the centrifugal circulating pumps.

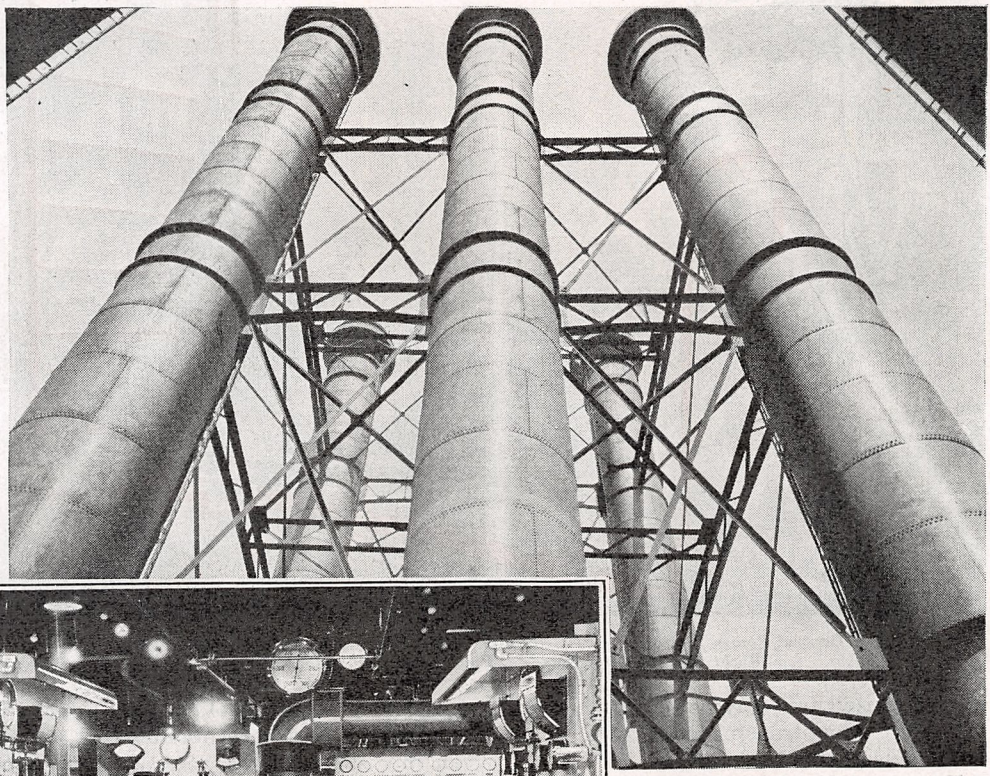
The danger of explosion is slight because all parts larger than the steam pipe are under vacuum rather than under pressure.

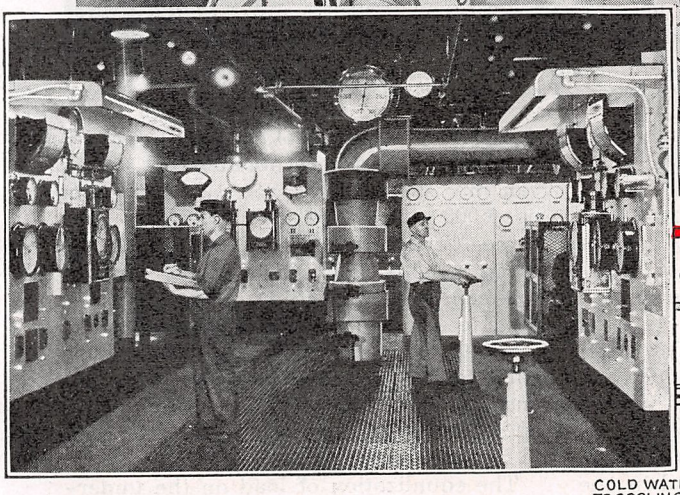
The great paradox of steam chilling is that you can introduce steam at one point

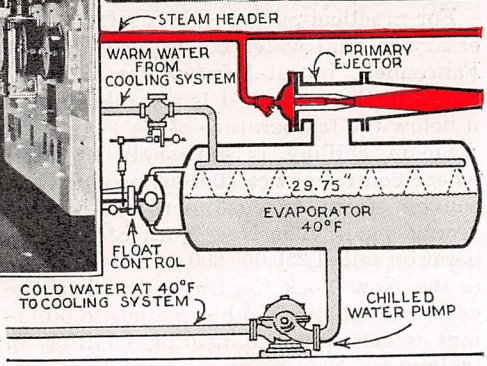


Left, Interior of Air-Conditioned Home; Bottom, Illustrating Method of "Steam Chilling"

from STEAM . . .



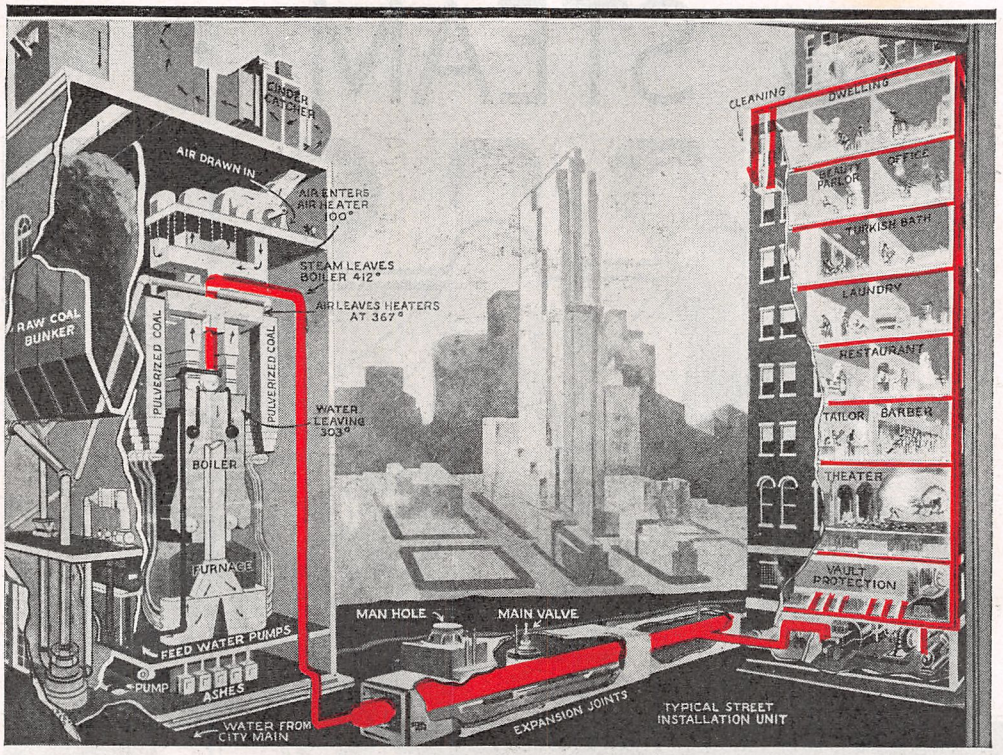




Top, Battery of Chimneys at Steam-Generating Plant; Bottom, Left, Boiler Operating Room; Bottom, Right, Equipment for Chilling Water

at a temperature of 350 degrees Fahrenheit, and get cold water at a temperature of forty degrees Fahrenheit, which is only eight degrees above freezing. The difference at two ends of the apparatus is 310 degrees.

The way steam chills air can be explained by a comparison with the feat of boiling potatoes on the top of Pikes Peak. At this high altitude the water boils at a lower temperature than at sea level. If you go a step further and create a vacuum in a water tank, you can get water to boil at forty degrees Fahrenheit, which is pretty cold. The evaporation of boiling water cools the remaining water correspondingly. The chilled water can then be passed through the pipes of a cooling system, or



How Central Power Station (Left) Generates and Delivers Steam to Building, Shown at Right, for Heating, Cooking, Power and Industrial Services

it can be used as a spray to wash and cool air before being transmitted through ducts to various parts of a building.

For practical purposes, it is seldom necessary to chill water below forty degrees Fahrenheit, but if brine water is introduced in the system, it is possible to chill it below the temperature of ice.

Steam chilling is extremely practical where central power stations produce and convey steam to customers via underground pipes. The New York Steam corporation sells 1,250,000,000 pounds of steam to the New York Central railroad in one year, and billions of other pounds to buildings which have no heating facilities of their own. Now the company is using its regular steam pipes for delivering steam to chill buildings.

The most recent installation of chilled steam equipment is in the new British Empire building, in Radio City. The system distributes 240,000,000 cubic feet of conditioned air every hour, and circulates 2,600,000 gallons of refrigerated water. The air conditioning is noiseless.

Between steam cooling and electrical cooling, the costs are about equal if you can buy steam at the rate of sixty cents per 1,000 pounds and electricity at one and three-fourths cents per kilowatt hour. It costs, roughly, about two-thirds as much to steam-chill a building in summer as it costs to steam-heat it in winter. According to the current rate, it costs $2 per 1,000 cubic feet to heat a large building for one heating season. To cool the same volume of space would cost between $1.25 and $1.50 for the cooling season.

The equalization of load on the underground pipes of a public utility company selling steam is one factor greatly in the favor of steam chilling. It is estimated that many customers now buying steam-heating service only could also buy steam chilling for a fractional additional cost.

The application of steam jet cooling to the home has not been carried on extensively, although it is practicable. Heating and cooling units are now made which use the same boiler for both summer and winter air conditioning.

"Invisible Dust" Curtain to Halt War Planes

"Invisible dust" which can halt airplane engines in midair and can be hung as a vast curtain or protective wall about a nation's borders to guard against sky invaders is the object of experimentation in Europe. Nikola Tesla, famous inventor, claims he has discovered force rays which can be projected like long curtains and through which planes cannot penetrate. These rays, he said, would be made of particles, possibly dust of some sort, microscopically fine, driven electrically and projected into walls miles high and 100 miles each in length. The particles would travel with the unheard of velocities of 50,000,000 volts. Ten thousand planes flying into one of these curtains would all be destroyed, the inventor averred, and visioned force projecting plants set up every 200 miles along a nation's borders, each shooting rays 100 miles on either side. Tests of this form of defense are said to have proved successful when several planes flying into such a curtain were forced to land through engine failure. The dust beams would shoot in straight lines and it is said complete and permanent engine failure results when the particles are "breathed" by the motors of a plane. Anti-aircraft guns could project the dust curtains.

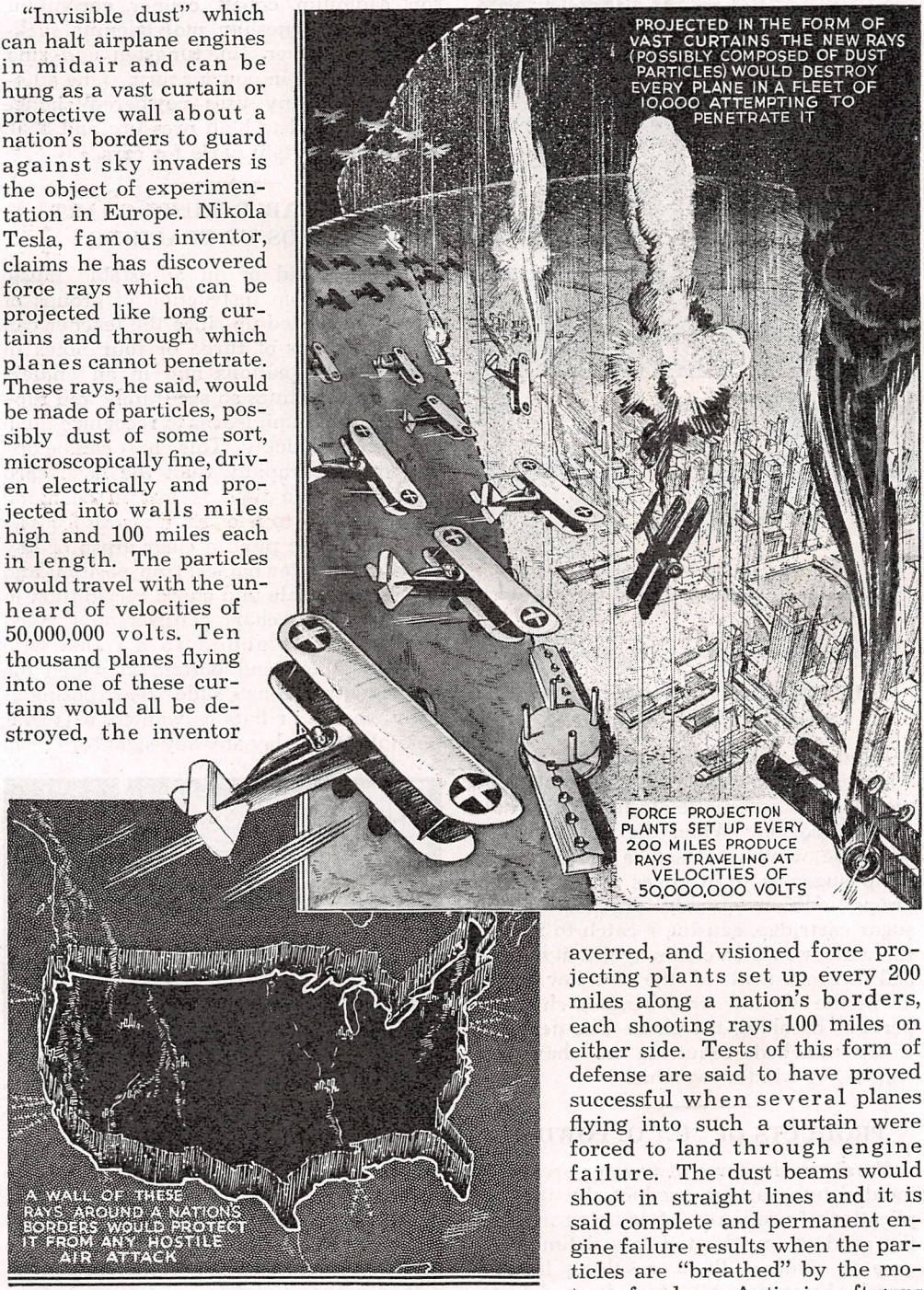
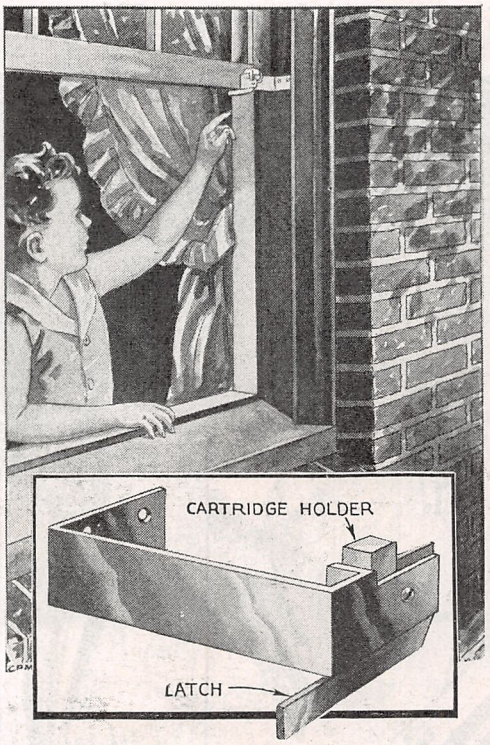


Diagram Showing How Country Would Be Protected from Plane Attack by Impenetrable Curtain of Force Rays



Automatic Device, Inset, Closes Window When It Rains; Above, Device in Open Window

AUTOMATIC WINDOW CLOSER WORKS WHEN IT RAINS

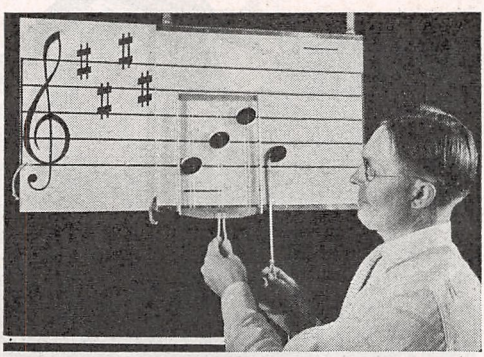
Windows in the home may be lowered when it rains in the owner's absence by means of an automatic closing device now on the market. When the device is set, with the window raised, a piece of soft lump sugar is inserted as the cartridge. Drops of rain quickly disintegrate the sugar cartridge, causing a catch to release the window, which closes by gravity. Special arrangement of the window ropes keeps the window from banging shut and perhaps breaking the glass. The device is easily attached, requiring no change in window or window weights.

PRODUCTS OF METAL POWDER

Metals in the form of powder are being molded into various products by the application of pressure. After being molded, the products are heated to a definite degree to coalesce them, resulting in firm metal objects, usually free from defects. The process replaces certain methods of casting. Eighteen elements or metals, including aluminum, arsenic, antimony, boron, cadmium, cobalt, copper, chromium, iron, lead, magnesium, molybdenum, nickel, silicon, silver, tin, tungsten and zinc, are obtainable in powder form. One automobile company uses powdered sponge iron, subjected to high pressure and heat, to produce certain parts for cars.

ADJUSTABLE MUSIC CHART SPEEDS UP TEACHING

With the aid of an adjustable music chart, classroom instruction of groups of pupils is speeded up since the teacher can present groups of three or four notes in various combinations and in an endless number of settings so accurately and rapidly that the pupil learns to recognize them much more quickly. This chart can be operated more rapidly than the flash card system and no time is lost in changing from one key to another. It is also possible to give the pupil a clear grasp of key signatures, letter names, transposition and elementary scale and chord recognition in all keys. The chart consists of a ruled cardboard attached to a frame with grooves at top and bottom in which the key signature charts slide. By exposing as many sharps or flats as wanted, it is thus possible to display any key signature from one to five sharps or flats. There are two note holders, one consisting of a metal frame on which three notes slide up and down on piano wires while the other is a single note on a handle. Using the two together makes possible an almost endless combination of tone groups.



Teaching the Meaning and Position of Musical Symbols Is Made Easy by Adjustable Chart

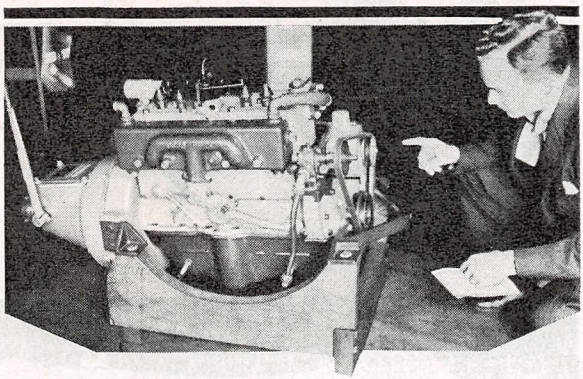
Asbestos Suit and Umbrella Protect Fireman

Fire Fighter in Asbestos Costume and Carrying Asbestos Umbrella Pushes His Way into the Flames with Hose, Attacking Fire at Its Source; Inset, Fireman in Protective, but Strange-Looking Suit

London fire fighters now carry umbrellas when fighting flames at close quarters, but the umbrellas are made of asbestos instead of silk and protect the firemen from the flames. The fire brigades are also equipped with asbestos suits, complete even to gloves and masks. With such an outfit a fireman can virtually wade through flames and come out unscathed. It enables hose crews to fight fires at closer quarters.

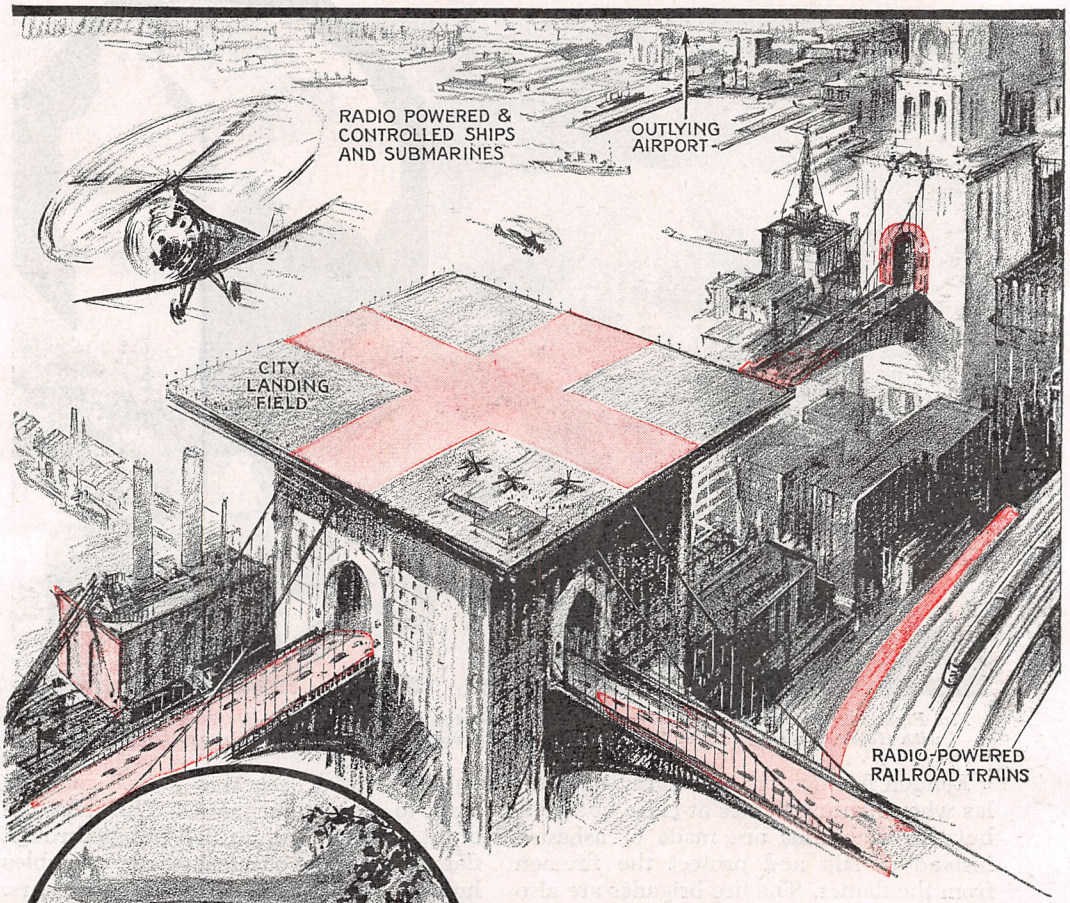
Conversion Kit Adapts Model A Engine to Operate Boat

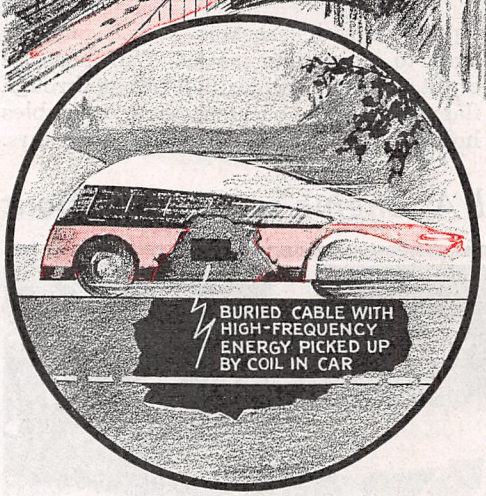
Ford Model A engines can be converted for use in boats by using a kit and special equipment now on the market. The kit comes complete with all necessary bolts, fittings, washers and adapters. An oil cooler, three-in-one manifold and a reverse gear in a special housing also may be obtained, if the owner desires to put his boat and engine in condition for hard service. The Model A motor with standard head, pistons, carburetion and ignition is rated at forty-brake horsepower at 2,200 revolutions per minute.



Model A Engine as It Appears Mounted for Use in Boat; Special Kit Facilitates Conversion of Motor to Marine Purposes

POWER to come

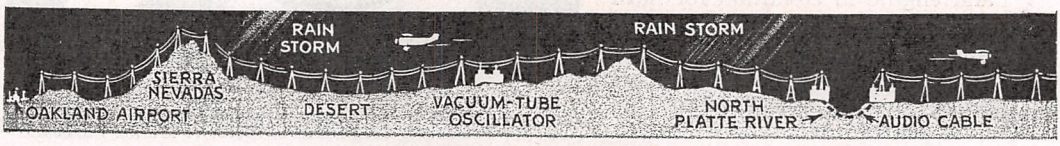




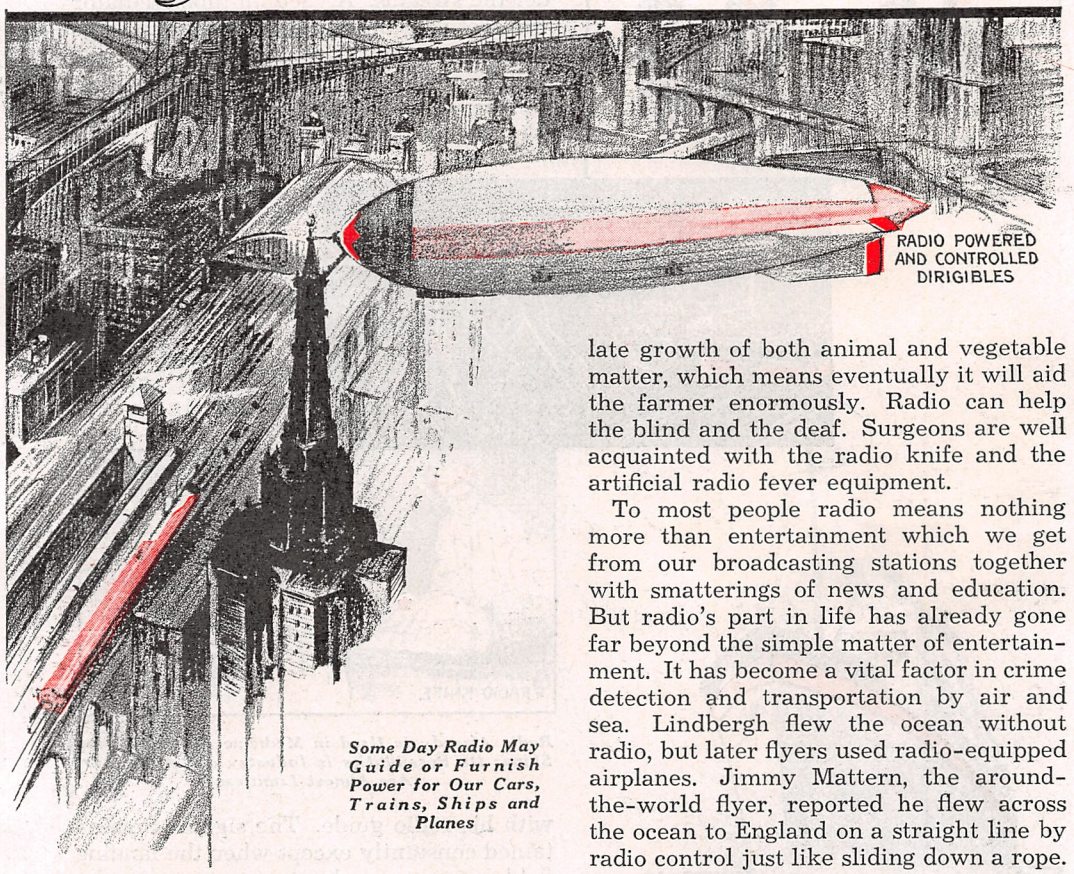
By EARL C. HANSON
Famous Radio Inventor
As told to Chas. J. Gilchrest

DEVELOPMENTS in radio have come with such startling rapidity that it is hardly possible to say definitely there is anything radio will not be able to do. Already airplanes can be guided through storm and fog by radio and be kept exactly on their courses.

Aboard a ship coming into harbor the captain need have no eyes at all as long as



by RADIO



Some Day Radio May Guide or Furnish Power for Our Cars, Trains, Ships and Planes

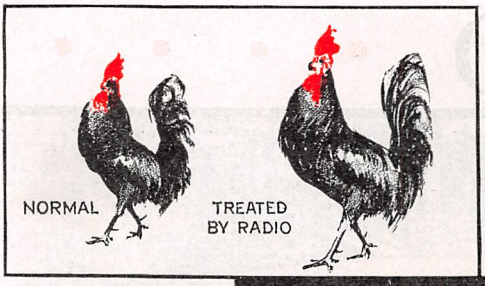
his ears can follow the tones produced by his special radio receiver. A cable laid along the harbor bottom in the middle of the channel carries the electrical impulses. His ears tell him if his ship has strayed too far from the line of the cable.

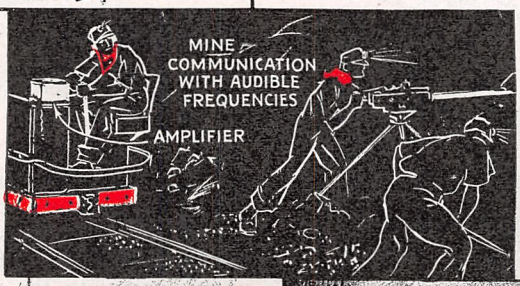
Motive power in the future will in all probability be furnished by radio for operating trains, automobiles, trucks, and street cars. Not only can the radio energy furnish the motive power, but also it can provide heat and light. In some not far distant time radio will be used to stimulate growth of both animal and vegetable matter, which means eventually it will aid the farmer enormously. Radio can help the blind and the deaf. Surgeons are well acquainted with the radio knife and the artificial radio fever equipment.

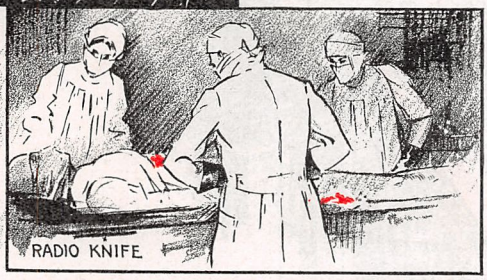
To most people radio means nothing more than entertainment which we get from our broadcasting stations together with smatterings of news and education. But radio's part in life has already gone far beyond the simple matter of entertainment. It has become a vital factor in crime detection and transportation by air and sea. Lindbergh flew the ocean without radio, but later flyers used radio-equipped airplanes. Jimmy Mattern, the around-the-world flyer, reported he flew across the ocean to England on a straight line by radio control just like sliding down a rope. It was that accurate.

The United States navy department took up the idea of guiding ships into harbors by radio many years ago. New York harbor was equipped and experimental installations made on the Atlantic and Pacific coasts. Research engineers of the war and navy departments have done remarkable work along the line of guiding craft with no one aboard.

Radio's most fundamental virtue to the flyer is the fact its signals are not stopped by night or fog. Blind conditions have long been the most dangerous hazard in







Radio Already Is Used in Medicine and in Guiding Ships; Its Possibilities in Industry and Agriculture Are Almost Limitless

over the airplane course from New York to Chicago. It will weave through the mountain passes, over the plains, and under the streams. A vacuum tube oscillator will motivate the wires and create the signals they radiate. On one side of the wires will be the course for flyers headed east. On the other the west-bound course. All the pilot has to do is to keep the signal from the wire constant in his receiver. One signal will take him to New York and another to Chicago just as surely as if he was riding on iron rails. Neither fog nor storm interfere with his radio guide. The signal is maintained constantly except when the landing field desires to send out a message, weather information, dispatching or traffic orders. This idea has been tried out successfully on commercial-type planes. Now it becomes practical for the private flyer and is the latest incentive for the increase of privately owned planes, for which it cuts insurance rates. For private planes the installation costs no more than $100, which is very inexpensive for an infallible guide even in the blindest of flying weather.

flying. Fog is the pilot's greatest bugaboo. Sunshine can't get through it and it is hard to believe artificial light of any sort can do what the sun cannot. But radio can.

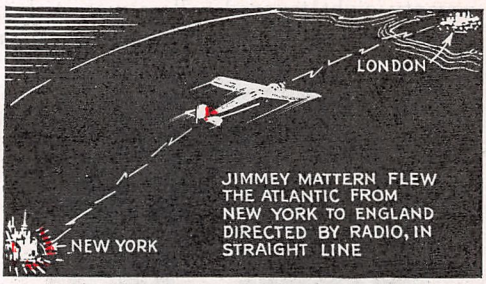
A long line of wire is being contemplated

The next step in the aviation control guiding system by radio, concerns landing and taking off from the field. Blind flying tests have proved this system safe even when the pilot can't see a thing. Let us say, for example, the flyer is approaching the field and planning to land. At 4,000 feet from the field a radio signal warns him he is just that far away. His altimeter

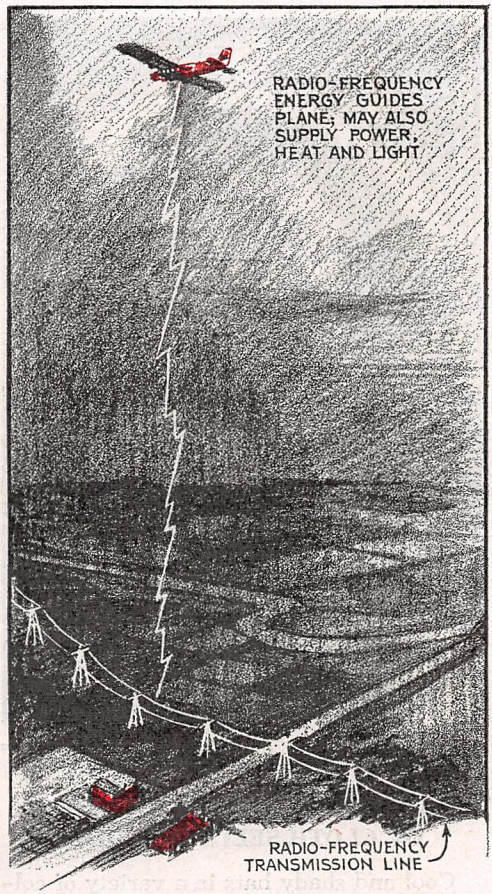
The Same Radio Energy Which Can Guide Planes May also Furnish Heat and Light for the Home

gives him his altitude. Then the radio station at the landing field contacts him, giving him wind direction and velocity so he can plan his landing accurately. When the field is clear and it is safe for him to land, the ground operator radios him and he can circle the field and come in. This is what I call the radio elevator.

The autogyro is gradually coming into its own in commercial aviation. Its main



virtues are the little space necessary for landing or taking off and the ability to fly at slow speeds. For a long time the principal trouble with passenger flying has been the time lost by the passenger in getting to the flying field for the take-off and getting from the flying field on landing at the other end, to his destination in that city. Our flying fields are always so many miles away from the center of business that the busy executive must lose an hour or so at each end of the flight. Just as radio can control airplane flights, it can control autogyro flying and aid materially in making the autogyro the short-haul



ship, for it can land in parks, or on top of big buildings. From such headquarters in congested sections it can fly passengers to and from the airport. Autogyros, will, I firmly believe, play a very important role in cooperation with the radio elevator. Passengers can be carried quickly from the business sections to outlying airports.

The cable system for guiding ships into harbor can be applied to ocean flying and to guiding blind persons. Wave lengths of 30,000 to 600,000 meters have been proved to be practical. These frequencies will travel through fog or water with no loss. Radio also can be used in communicating with people in underground mines. The trouble has always been that the minerals in the ground have killed radio signals just as a steel viaduct or bridge hampers the radio in cars. But by using this same cable system such a method of talking to the surface has been devised.

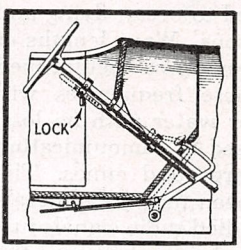
(Continued to page 120A)

One-Piece Fabric Hat, Inset, Shown as It Appears on Wearer's Head; the Crown Stretches

HAT STAMPED FROM ONE PIECE OF CLOTH SELLS FOR DIME

Cool and shady hats in a variety of colors are being produced to sell for ten cents each. The hats are die stamped from a single piece of buckram in such a manner that the crown of the hat stretches over the head when the brim is pulled down.

AUTO BRAKE AND CLUTCH LOCK PREVENTS REMOVAL OF CAR



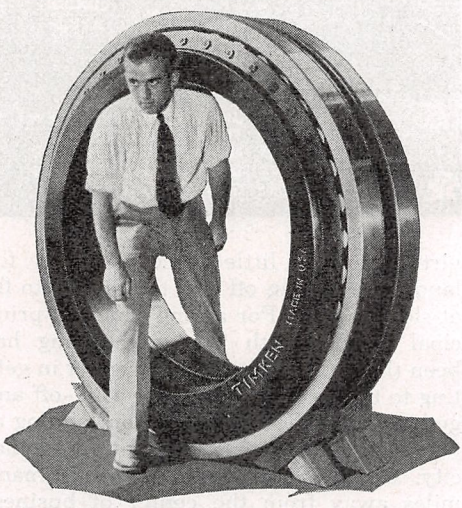
Removal of the automobile from its parking place can be prevented by a device that locks the brake and clutch. It cannot be filed, sawed, chiseled or cut with any tool other than a cutting torch and cannot be opened with master keys. The device is case-hardened. It can be attached to the steering post in thirty minutes and, unlike wheel locks of certain types, does not weaken the steering apparatus. The locking post also can be used in adjusting brakes, changing tires on inclines and locking the car safely while the motor runs to build up the battery or to warm up in cold weather.

RAND GOLD MINES ARE SALTED TO KILL HOOKWORMS

Gold mines on the Rand, in South Africa, are being salted to prevent the hatching of hookworm eggs and to kill the larvæ. After some 200,000 blacks and 20,000 white miners became afflicted with hookworm, a salt solution above twenty per cent was used to scour corridors, buckets, cages and banisters and all exposed earth and waste was covered with a layer of salt an inch thick. Now the disease is no longer a physical handicap to the workers.

MAN-SIZED ROLLER BEARING CARRIES GREAT LOAD

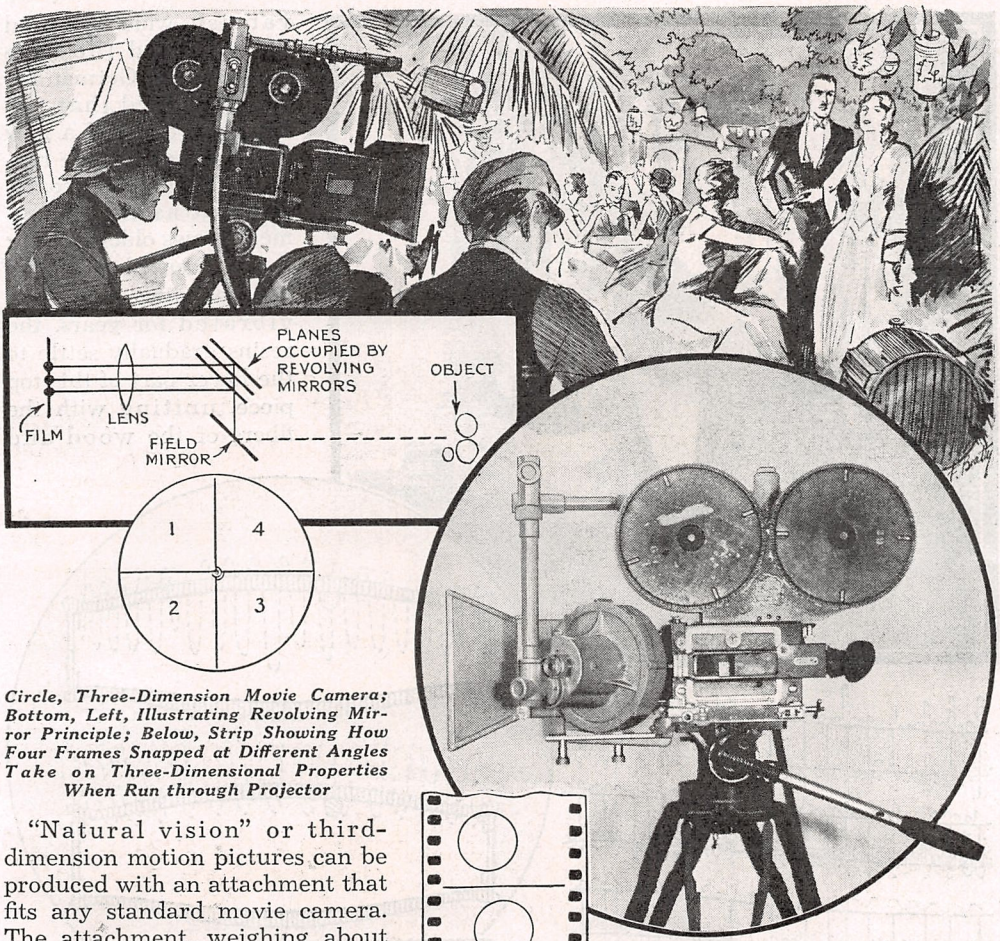
So large that a man can walk through it, a giant bearing designed for use in a cement mill can carry a load of more than 1,000,000 pounds. The bearing, containing seventy-eight tapered rollers mounted in two rows, weighs two and three-quarter



So Large That a Man Steps through It, This Bearing Carries Huge Loads

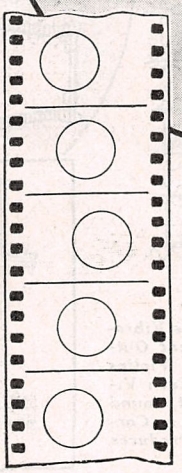
tons. Bearings of still greater capacity are made by the Timken Roller Bearing company for use in large plants.

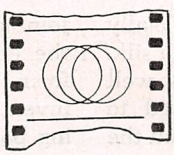
"Natural Vision" Is Latest Movie Invention



Circle, Three-Dimension Movie Camera; Bottom, Left, Illustrating Revolving Mirror Principle; Below, Strip Showing How Four Frames Snapped at Different Angles Take on Three-Dimensional Properties When Run through Projector

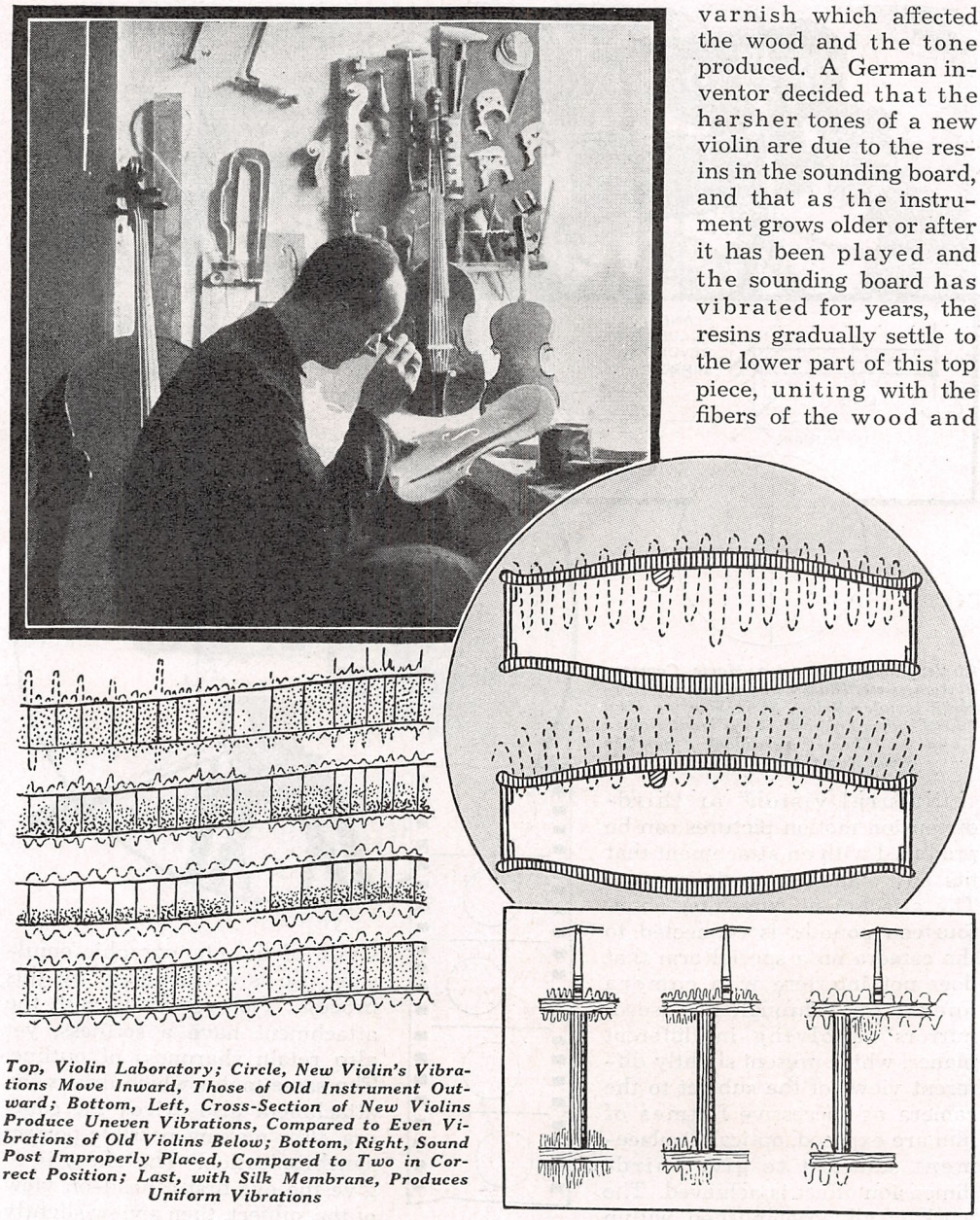
"Natural vision" or third-dimension motion pictures can be produced with an attachment that fits any standard movie camera. The attachment, weighing about fourteen pounds, is connected to the camera on a special arm that does not interfere with camera operation. Through the use of mirrors revolving in different planes, which present slightly different views of the subject to the camera as successive frames of film are exposed, optical displacement sufficient to give third-dimension effect is achieved. The work is all accomplished within the camera, eliminating attachments for the projector in which the film is used and special devices for the eyes of the spectator. Distortion of the picture when viewed closely from the side of the screen is virtually eliminated.





Grain of the photographic emulsion also is eliminated by this process. Pictures made with the attachment have a softness, yet also retain sharpness of outline. The same motor which drives the attachment also drives the camera, thus making possible perfect synchronization. The effect is to give the eye first a head-on view of the subject, then a view slightly to the right, then a view head-on and finally a view slightly to the left. As the film is run through the projector, the eye is not conscious of the four separate views. Instead, the subject appears to have depth, a result long sought.

Violins "Aged" Artificially with Silk Linings



Top, Violin Laboratory; Circle, New Violin's Vibrations Move Inward, Those of Old Instrument Outward; Bottom, Left, Cross-Section of New Violins Produce Uneven Vibrations, Compared to Even Vibrations of Old Violins Below; Bottom, Right, Sound Post Improperly Placed, Compared to Two in Correct Position; Last, with Silk Membrane, Produces Uniform Vibrations

New violins are being "aged" artificially in Germany by lining the insides with silk. The tone quality of old violins is well known and this has been attributed to many causes, among them a belief that the old violin makers used some sort of secret varnish which affected the wood and the tone produced. A German inventor decided that the harsher tones of a new violin are due to the resins in the sounding board, and that as the instrument grows older or after it has been played and the sounding board has vibrated for years, the resins gradually settle to the lower part of this top piece, uniting with the fibers of the wood and joining the tree rings until the vibration of the entire sounding board becomes uniform. To hasten the process of aging, this inventor lines the inner side of the sounding board with a thin silk skin, producing a tone quality like that of old violins.

Camera on Motorcycle Films a Bicycle Race

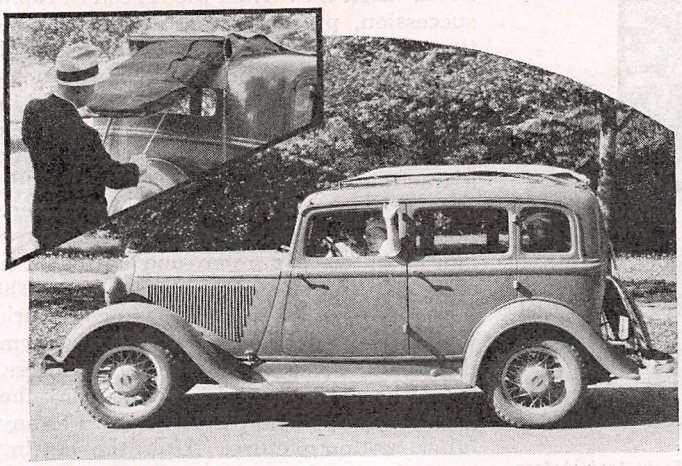
Spectacular effects were obtained in making a motion picture of a bicycle race by mounting the movie camera on the rear of a motorcycle. The motorcycle traveled around the track in one direction while the racers pedaled in the opposite direction, the cameraman grinding away as his mount bore down on the riders who separated to form a lane for the mounted camera as they came abreast of it. The arrangement resulted in several bad spills in one of which several riders and the cameraman and motorcycle driver were injured when the wheel of a bicycle collapsed as it neared the motorcycle and the cyclists piled up with the motorcycle.

How Camera Is Set Up to Make Movies of Fast Moving Bicycle Riders

© International News Photos

CLOTHES BAG ON CAR ROOF SOLVES PROBLEM

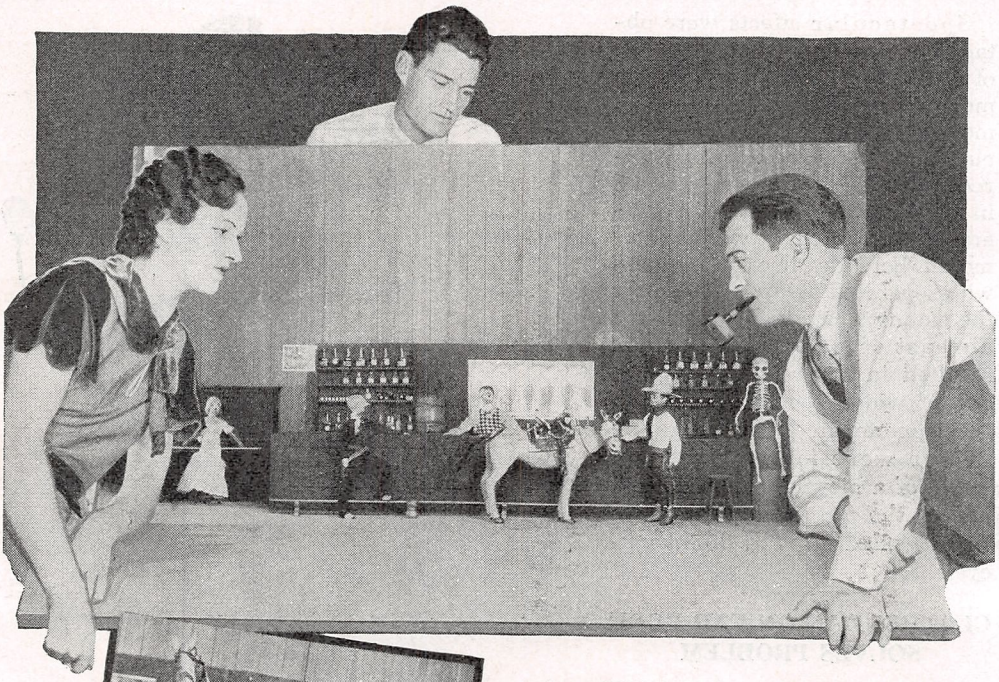
Clothes are kept unwrinkled and in press in a roomy bag with large compartments which fits into a waterproof and dustproof canvas case which in turn is securely attached to the roof of the car. The bag solves the luggage problem when motoring as it is out of the way and holds as much as several suitcases. The canvas case is attached to the rear bumper with a pair of metal springs and with rope fasteners in front. The springs hold the case taut but do not touch the car. The clothes bag is pulled into place in the case by hooking it to a pull cord with which the inside of the case is equipped. The bag is equipped with handles and one pull on the bottom handle brings the bag out where it hangs down the back of the car. When detached from the pull cord hook it can then be folded in the middle and carried by the two end handles like a suitcase. If an article is wanted on the road, the bag can be pulled out and opened without removing it from the case.

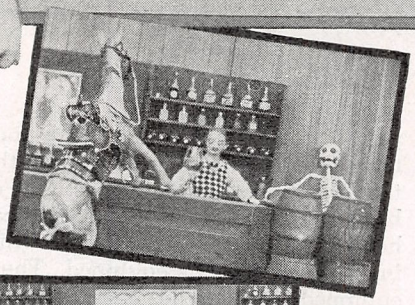


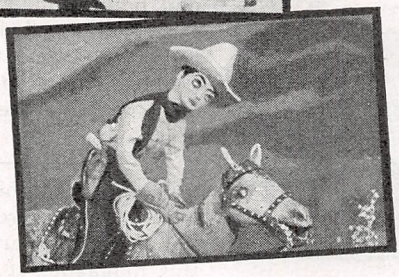
Bag Attached to Roof of Car Keeps Clothes Unwrinkled; Inset, Inserting Bag in Waterproof Case

¶Our Bureau of Information will answer questions regarding articles in this magazine, if accompanied by a stamped, self-addressed envelope.

Eight-Inch Actors Appear in Midget Movies







Top, Small Movie Set on Which Eight-Inch Actors Perform; Below, Several Scenes in Which the Small Plastic Figures Were Used in Midget Movies

One Hollywood producer is making a series of motion pictures in which the actors are eight-inch figures that perform like real troupers. Their lifelike movements are attained by shooting the scenes with what is known as "stop motion." Each progressive pose of a figure in motion is taken separately, then the figure is moved and another shot is taken. Such shots, when thrown on the screen in rapid succession, present smooth realistic motion. The figures are of plastic material with enough resilience to prevent cracking. Infinite care and skill are required in working the individual figures as each successive pose varies in progression but a fraction of an inch from the preceding one. For instance, 130 distinct poses were necessary in order to show one of these figures entering a room and sitting in a chair. To film a one-reel picture of 1,000 feet requires five weeks of steady work with these little figures, for putting them through their roles is a tedious process. Once the entire action is on the film, the pictures are cut and edited the same as any other motion picture. After the cutting and editing, they are synchronized with sound effects, voices and music.

FLY CATCHING CONTEST

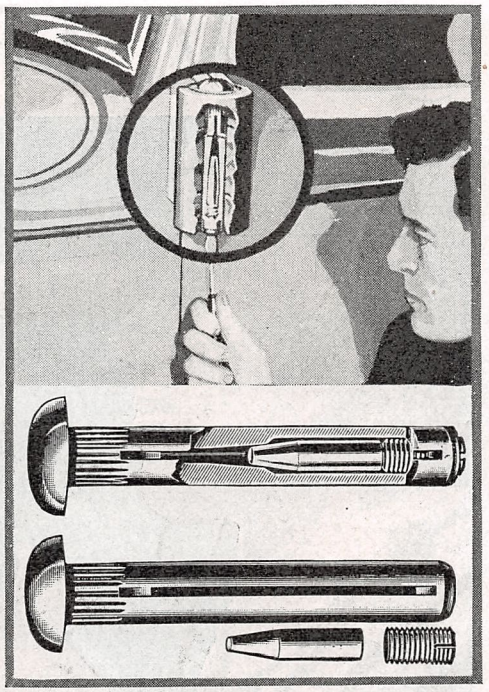
Tokyo recently concluded a city-wide fly catching contest to help rid the city of the pests. It was won by a man who claimed he had bagged 198,000 insects and received a prize from the mayor for the feat. Second honors went to a fly catcher with 190,000 to his credit. The contest resulted in an inquiry from a foreign country on price quotations for 5,000,000 flies to be used for goldfish food, but it was necessary to disappoint the prospective buyer because the contestants had not saved their flies.

YOKE STOPS RUNAWAY DOGS BY BUMPING LEGS

Yokes similar to those farmers use to prevent cows from jumping fences are now being attached to dogs to keep them from running away. The yoke is fastened about the neck and can be adjusted so it does not interfere with the animal when he walks or trots, but begins bumping his legs when he starts to run. It is useful in training dogs to obey commands, and the animal soon learns to stop when ordered after which the yoke can be discarded.

Yoke Bumps Dog's Legs When He Runs; It Is Used for Training Purposes

¶Automobiles registered on January 1, 1934, numbered 33,562,059, a decrease as compared with the beginning of 1933.



Cross-Section of Hinge Pin; Circle, Installation in Door of Automobile

CAR DOOR HINGE PIN EXPANDS TO TAKE UP WEAR

Expansion lubricated hinge pins for automobile doors are being offered as replacements for worn and rusty pins. The new pin is made of three parts, the pin, the expanding plug and the adjusting screw. The hollow center is packed with heavy grease before installation to keep the hinge and pin lubricated indefinitely. The adjusting screw, tightened with a screwdriver, causes the plug to expand until the door is held securely, eliminating rattles.

INSULATION MADE OF FINE SAND

Heat-insulating material, described as "an impalpably fine network of purest sand, interlocked with air and extremely light in weight," has been introduced recently. The most powerful microscope fails to reveal its texture. The insulating power is estimated at ten per cent more than that of still air and almost double that of many commercial heat insulators. The material withstands a temperature of 1,500 degrees Fahrenheit. It is intended for use in refrigerators, electric ovens and furnaces.

NEW TRICKS of

IF you could do something about the weather, the whole world would hail you, for millions of dollars and many lives would be saved every year. Next to a means of weather control, mankind needs some infallible way of predicting tomorrow's weather today, although meteorologists are not certain that this will ever become an exact science.

Striving for greater accuracy in its forecasts, the weather bureau is increasing the data used in its calculations, is preparing to decentralize its service, and is trying out the new air mass analysis system to supplement present methods of forecasting. Air mass analysis, used in this country for the benefit of aviation, includes gathering daily data from the upper air.

"On the average, the weather bureau at present is right about eighty-five per cent of the time," Dr. Willis Ray Gregg, chief of the weather service, says. "With the

Following Ascent of Pilot Balloon with Theodolite to Determine the Direction of Air Currents and Launching a Weather Balloon

Weather Forecasting

changes now being made we hope to increase the accuracy of forecasts for the twenty-four-hour period and in addition make reasonably accurate predictions for as far as two days or more in the future. Also, we hope for exceptional accuracy in short forecasts, such as definitely foretelling the weather for the next eight hours.

Plotting Wind Forces and Directions at Different Altitudes from Information Telephoned by Observer Watching Free Balloon; Below, Instrument on Plane Which Records Air Conditions

This is vital for the safety of aviation."

Not only do meteorological officials expect to extend the time of their predictions, but they hope that shortly steps can be taken that will lead to accurate long-range forecasts, like predicting the weather a season or a year in advance. From studying weather cycles of the past several centuries, forecasters believe that the years of deficient rainfall in the United States are about over, but to date the study of weather cycles, sun spots, ocean currents, and other phenomena have been productive only in a general way and no truly accurate predictions can be based on them. One exception is a relation that has been found between Australian weather and the monsoon season of India. This allows forecasters to make quite accurate predictions ahead of time as to the dates and extent of the Indian storms.

"There is reason to hope that long-range forecasting will be aided by a study of the

July 1, daily airplane flights started at twenty stations in the United States, carrying instruments to 17,000 feet altitude, and giving the weather bureau three-dimensional conditions, including upper barometric readings and temperatures that cannot be obtained with the small balloons now used for studying wind currents. The theory behind the study is that weather changes occur when warm moist blocks

(Continued to page 116A)

Left, Battery and Parachute Used for Night Balloon Observations and Anemometer Which Registers Force of the Wind

temperatures and air currents in the stratosphere," Dr. Gregg says. "Man knows very little about conditions in the belt from ten to fifty miles above the earth and it may be that radio-controlled balloons carrying meteorological instruments can bring down data from which fairly long-range predictions can be made."

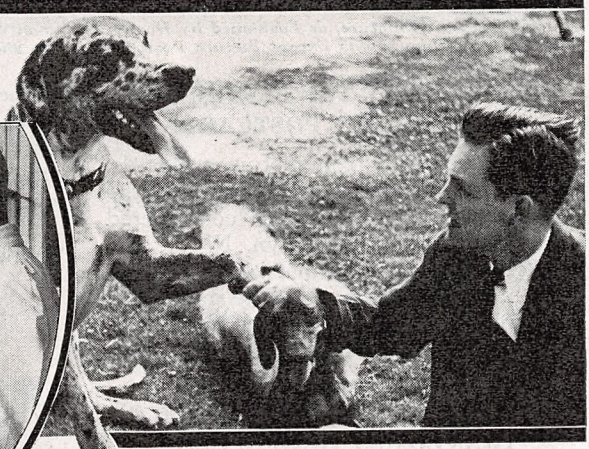
Stratosphere flights so far have revealed little except that the "drift" in the rarefied air is toward the southeast, the direction that is taken by many of the lower air currents that sweep across the United States. If the stratosphere has any secrets to reveal many flights must be made before enough data can be assembled on which to make forecasts. Meteorologists may even have to invent new instruments to record some of the things they will want to know.

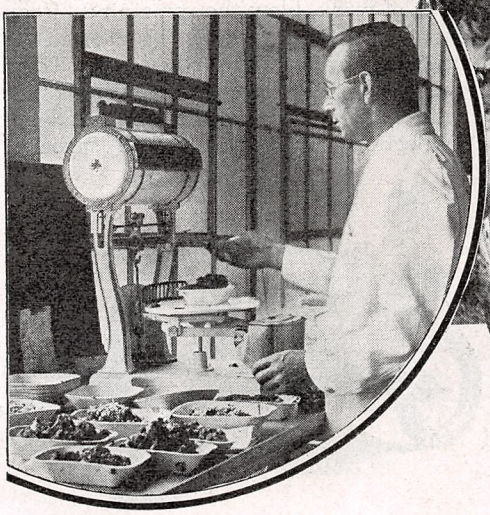
The study of air masses is the first step in observing the upper air. Beginning

Inspecting Weather Information on a Teletype Machine and, Above, Weather Bureau Official Studying Sunshine Recorder

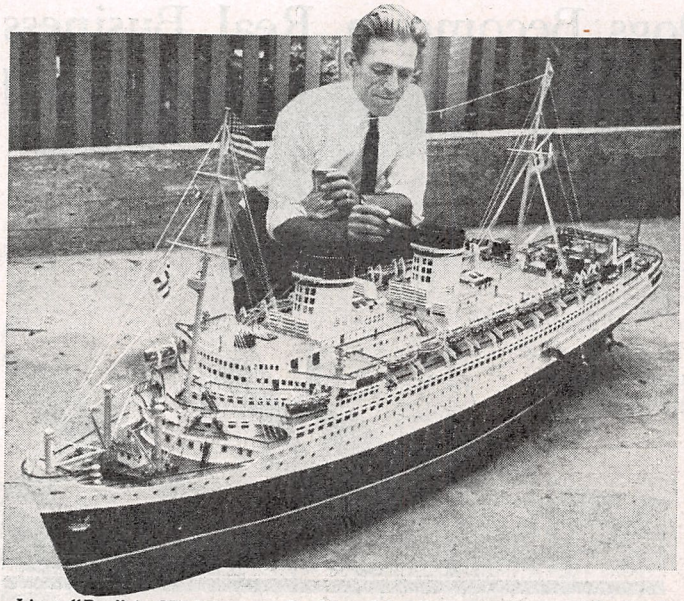
Catering to Dogs Becomes a Real Business

Dogs appreciate a fresh, neatly presented meal and their masters like to have them properly fed and healthy. That is why a depression-time business, started by LeRoy Goff II, of Philadelphia, in his own garage with no capital, has grown so rapidly that it numbers 6,000 animal customers—including several cats and a raccoon. It has outgrown the garage and now is housed in a modern plant at Philadelphia with branches in eight cities. The idea of canine catering originated in Mr. Goff's efforts to get the right food for his own dogs. With the help of a veterinarian he worked out a formula on which they throve. After struggling with a side of beef which he didn't know how to cut he offered a service of ready-to-eat meals for dogs to a few wealthy families. The idea met with favor. Attractive menu cards were printed from which the selections could be made. The menu includes two table d'hote meals: a veterinary meal and a kennel meal, and a la carte special meals, vegetables and beverages ("limed" milk, cod-liver oil and haliver oil). All products are government-inspected. On the table d'hote meals the dog receives lamb once a week, fish once a week, and beef the rest of the time. Meat may be ordered raw or cooked. The standard platter weighing about one pound is delivered for thirteen cents raw, and fourteen cents cooked. Deliveries to customers are made three times a week. Dog hospitals in the vicinity of the company are all among its patrons and send their ambulances for rations daily. The business is so new that its manager is still a bit bewildered by its sudden growth and his immersion into a whirlpool of activity.





Top, Preparing Dinners for Dogs; Note the Individual Food Containers; Bottom, Left, Food Is Weighed and Inspected Carefully; Right, Well-Fed Dog Is Healthy and Contented



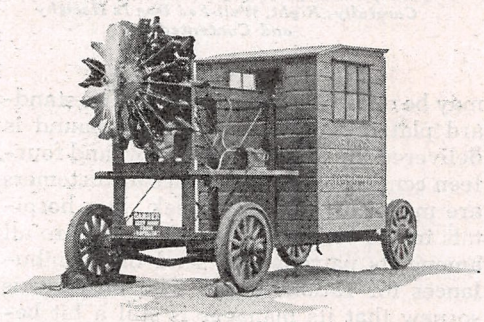
Liner "Rex" in Miniature, as Fashioned by Home Craftsman Who Had No Working Plans Except Picture Postcards of the Ship

ITALIAN LINER "REX" MODELED FROM PICTURE POSTCARDS

Modeled entirely from picture postcards, a small-scale ship closely resembling the Italian liner "Rex" has been constructed by a craftsman in Brooklyn, N. Y. The builder never saw the liner before assembling his eight-foot model. The small craft is complete in all details. All of the equipment was fashioned by hand.

MOTOR TEST STAND ON WHEELS TRAVELS AT HIGH SPEED

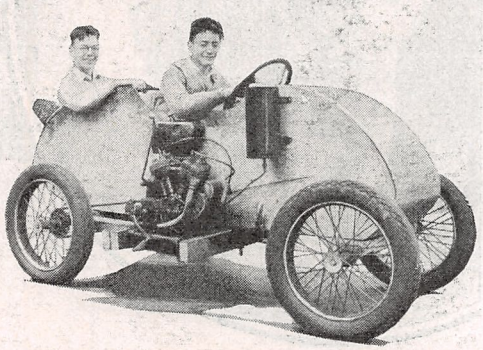
There is at least one building that can do seventy miles per hour. It is a small shop, part of a testing plant for airplane engines in use at the Roosevelt flying field on Long Island. The engine test stand and the building are mounted on wheels and the vehicle, with an airplane motor in place, can be propelled at a speed of seventy miles per hour.



Wheeled Testing Block for Aircraft Motors Also Carries Small Mechanical Repair Shop

JUNK PARTS AUTO IS CHAIN-DRIVEN

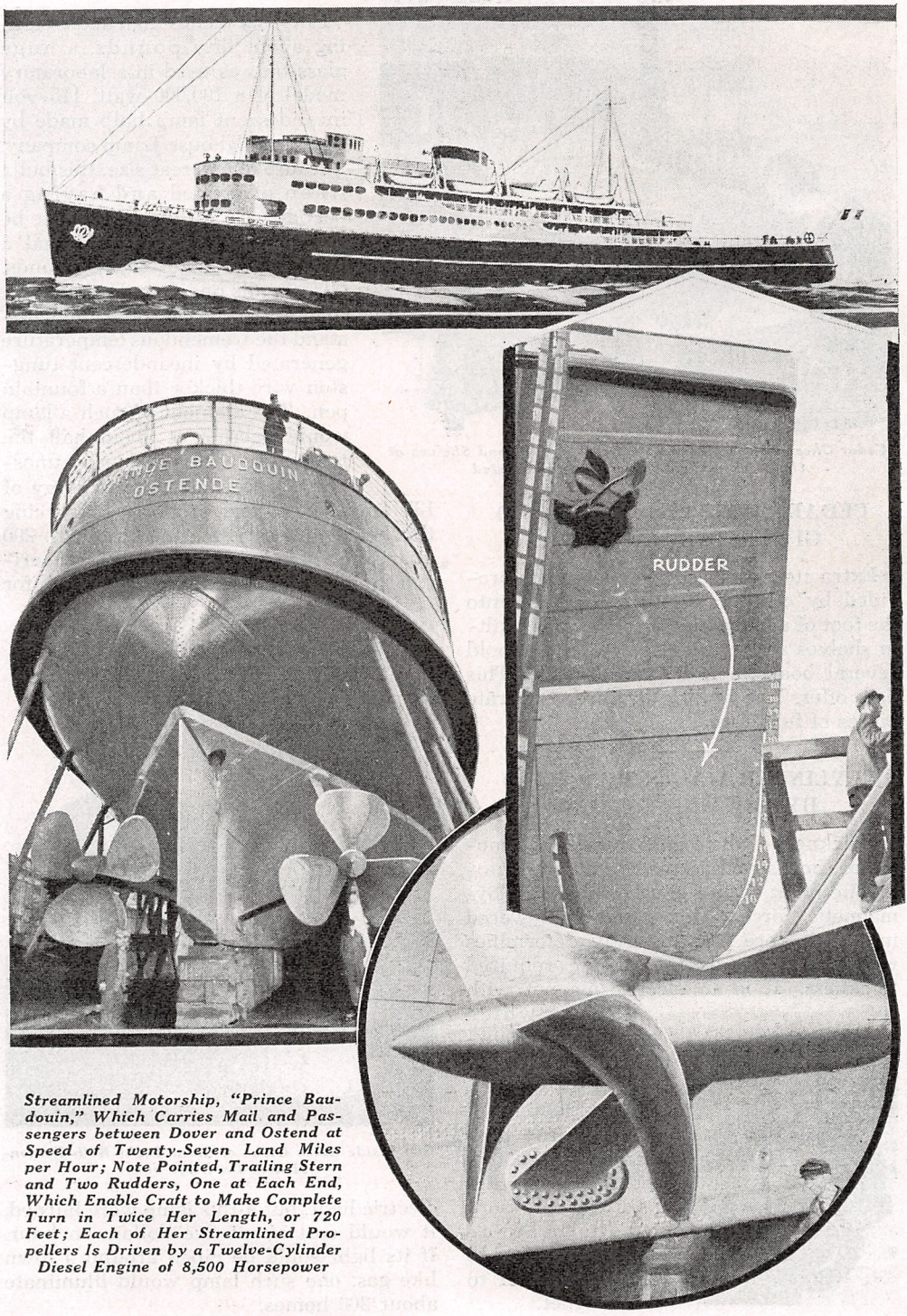
Two San Francisco school boys wanted an automobile but had only $9.65 after pooling their money—not enough to buy a car. So they decided to make one. They made a technical survey of every junk yard and motor wrecking establishment in town, spent $9.50 and two weeks of work, blew the remaining fifteen cents for oil, borrowed some fuel from the family car and were ready to go. Their vehicle has a streamline body, a motorcycle engine, a one-wheel brake and the "connecting rod" is a bicycle sprocket chain. They claim their chain-drive car will make forty-two miles per hour.



Chain-Driven Auto Made from Junkyard Parts Has a One-Wheel Brake

¶Popular Mechanics Magazine does not publish the name of the maker of, or dealer in, any device described in its pages, but this information will be furnished by our Bureau of Information upon request, accompanied by stamped envelope.

Two Rudders Enable Boat to Turn Quickly



Streamlined Motorship, "Prince Baudouin," Which Carries Mail and Passengers between Dover and Ostend at Speed of Twenty-Seven Land Miles per Hour; Note Pointed, Trailing Stern and Two Rudders, One at Each End, Which Enable Craft to Make Complete Turn in Twice Her Length, or 720 Feet; Each of Her Streamlined Propellers Is Driven by a Twelve-Cylinder Diesel Engine of 8,500 Horsepower

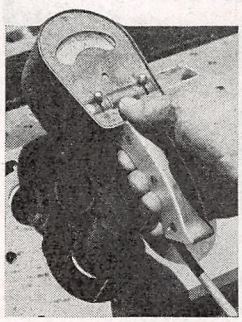
Cedar Chest Drawers in the Foot of This Bed and Shelves at the Head Utilize Space Usually Wasted

CEDAR CHEST IN FOOT OF BED GIVES STORAGE SPACE

Extra storage space for blankets is provided by cedar chest drawers built into the foot of a bed which also contains built-in shelves at the top large enough to hold several books, a radio and a clock. This bed offers the utility of three separate pieces of furniture.

CYLINDER WALLS MEASURED BY THICKNESS GAUGE

Thickness of the cylinder walls in a motor are measured accurately at one automobile plant with a gauge which employs magnetic force. This gauge is lowered into each bore and instantly determines whether the walls are of the required thickness. It is an electric magnet with a meter which measures the current needed to energize the magnet. As the volume of steel or iron presented to the two poles of a magnet is increased, more magnetic force will be required to hold the metal to the magnet.

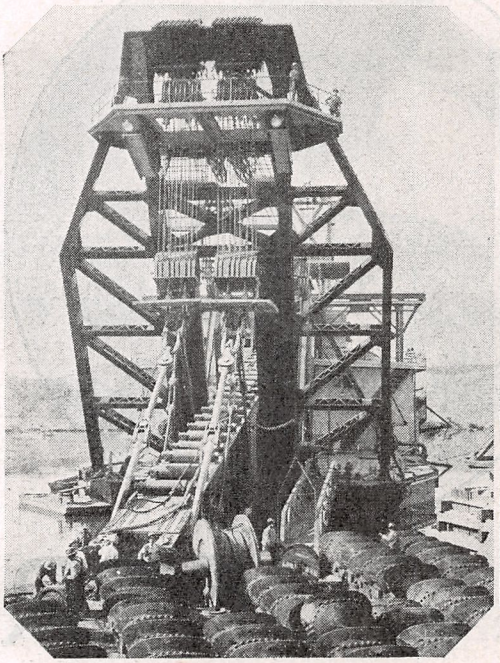


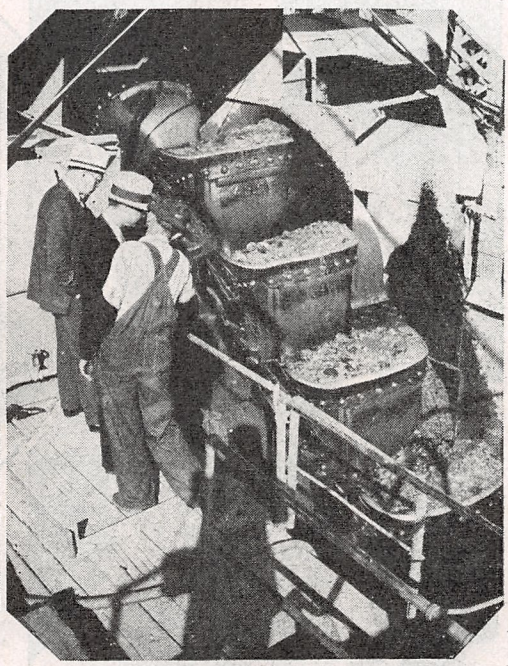
FIFTY-POUND LAMP BULB IS FIVE FEET HIGH

Fifty-six inches high and weighing about fifty pounds, a huge glass bulb is used in a laboratory model of a 100,000-watt, 115-volt incandescent lamp bulb made by the Westinghouse Lamp company. Because of its great size, this bulb, when exhausted and having a partial vacuum within, must be strong enough to withstand a crushing strain of 40,000 pounds. Glass walls one-fourth of an inch thick resist the crushing and withstand the tremendous temperature generated by incandescent tungsten wire thicker than a fountain pen. The filament of such a lamp would operate at about half the temperature of the sun's atmosphere, equivalent to an energy of 135 horsepower, and properly conserving this heat requires filling the bulb with 200 quarts of argon gas. The average American family pays about $2.50 per month for electric light, but if this lamp were burned, it would cost about five dollars an hour. If its light could be piped around a town like gas, one such lamp would illuminate about 200 homes.

Girl Inside Glass Globe of Giant Light Bulb Demonstrates Its Huge Size

Giant Dredge Digs Deep for Gold-Laden Ore



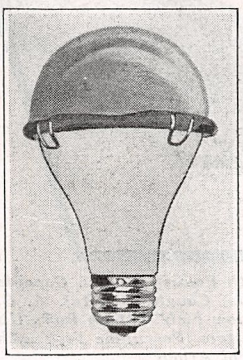


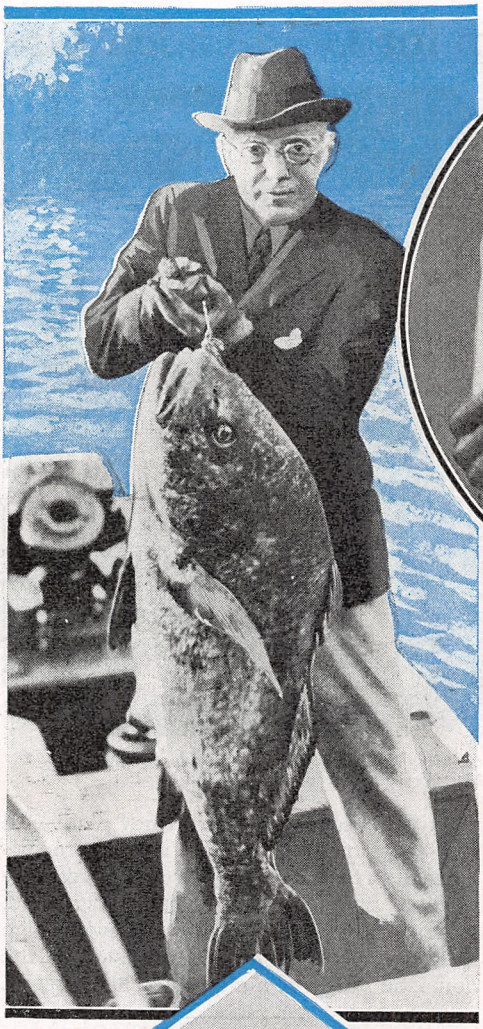
Left, Digging End of Dredge Before Buckets Were Attached; Fully Equipped, Dredge Weighs 3,500 Tons; Right, Endless Conveyor with Gold-Bearing Gravel Scooped from the Depths

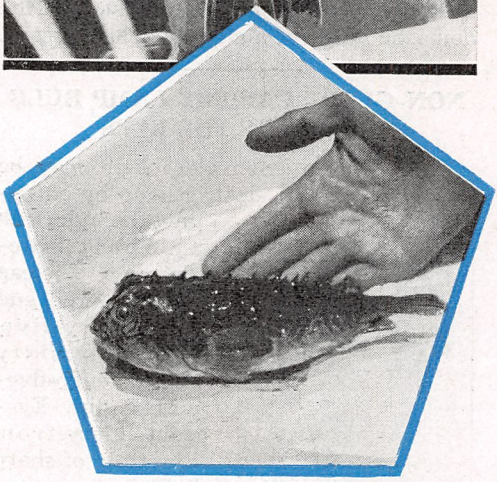
Digging, washing and stacking nearly 400,000 cubic yards of gravel a month, a giant gold-mining dredge is being operated in the Hammondton area of northern California, known as the most extensive gold fields in North America. Having a total length exceeding that of a small ocean-going steamer, and weighing 7,000,000 pounds, the monster nudges its huge nose into the gravel banks, bringing up, in giant steel buckets mounted on an endless conveyor line, some 15,000 cubic yards of gold-bearing material every twenty-four hours. A huge steel crane raises and lowers the bucket line to the desired position, enabling the dredge to work to a record unheard of depth of 110 feet below water-level as well as 30 feet above, or a total perpendicular range of 140 feet. As it comes aboard, the gravel is distributed over rows of riffles, where quicksilver picks up the fine gold particles as the gravel-laden stream of water passes down the incline. Washed material is fed to a four-foot rubber conveyor belt running on the stacker or "ladder" that reaches out 250 feet behind the dredge. The machine is a complete placer-mining plant—all self-contained and so efficient as to recover with profit the values from gravel carrying as little as six to seven cents a yard. Operated by electricity, the new dredge consumes enough current to supply the domestic needs of a city of 70,000 persons.

NON-GLARE CAP FOR LAMP BULB PROTECTS THE EYES

More efficient, non-glare light may be obtained from an electric lamp by equipping the bulb with a cobalt blue-glass cap. The cap fits the large end of twenty-five, forty, fifty, sixty and seventy-five-watt bulbs. Eyesight injury from the strain of sharp light is prevented by the soft glow from a capped bulb.







Top, Left, Drum Fish with Powerful Teeth Capable of Crushing Oyster Shells, Caught by Maj. A. B. Lambert; Top, Right, "Blow Fish" Which Puffs Up to Frighten Enemies; Bottom, Porcupine Fish with Its Coat of Armor

QUEER

By ANTHONY V. RAGUSIN

EXPLORERS have covered almost every foot of land on the globe, but the sea, with its many strange inhabitants, still holds a challenge to the man looking for new thrills and adventures. The Gulf of Mexico is especially fascinating for its marine life. Deep-sea fishing among the islands off Biloxi, on the Mississippi coast, will generally reward the fisherman with plenty of sport and some almost unbelievable residents of the sea.

The sharksucker or remora, one of the oddities of the sea, is the original hitchhiker. With its waterboard or adherent pad on the top of its head, furnishing a suction-like arrangement, this fish attaches itself to the side of some big fish and rides for miles. Early mariners called the remora the "ship-stayer" because it often hitched itself to boats.

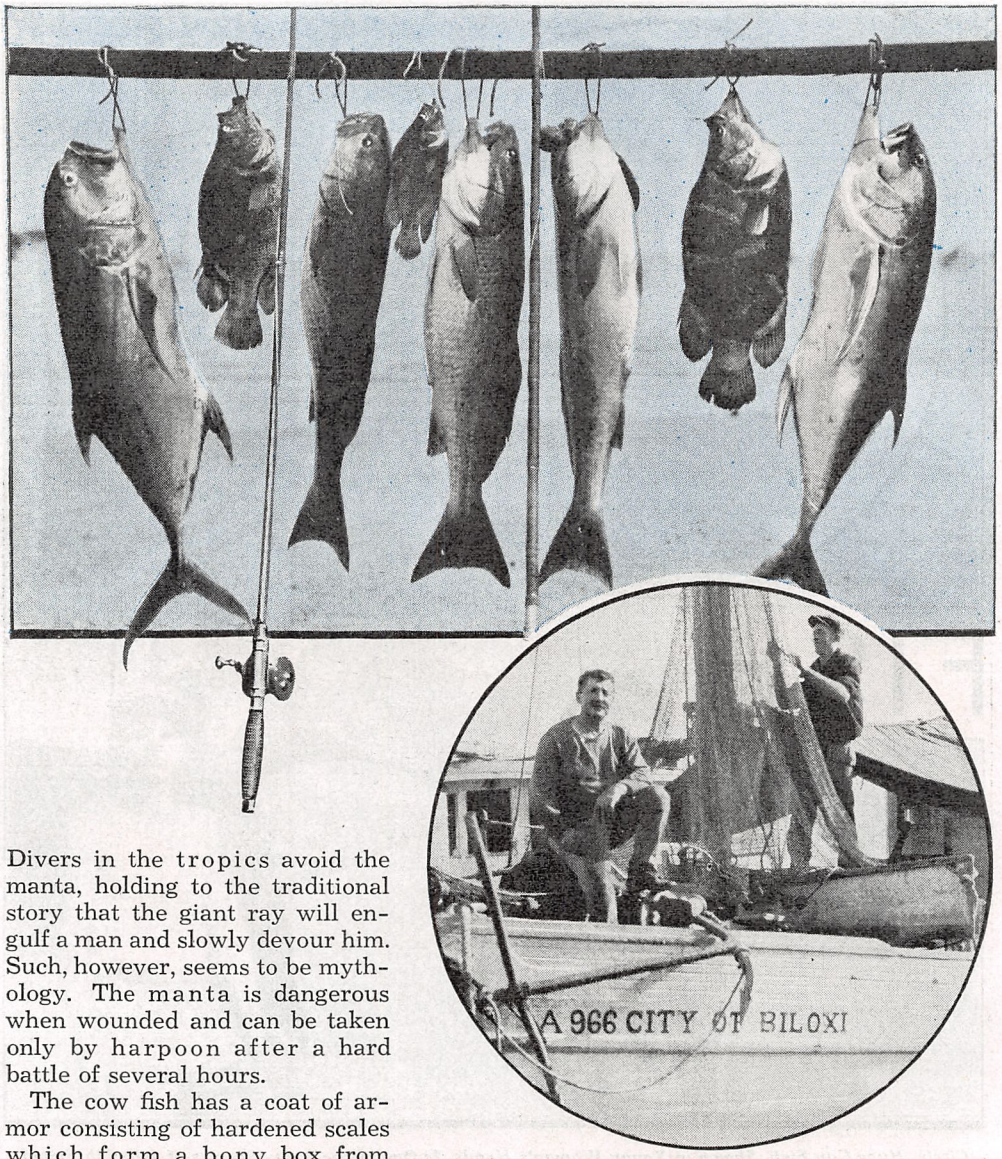
Flashing like a Toledo blade, the cutlass fish, sometimes called the silver eel, is practically the shining sword of the Gulf. It is thin and shaped like a cutlass and has a small mouth with sharp needle-like teeth. Due to remarkable flexibility, it

Circle, Huge Cup Fish, Shown in Young Woman's Hands, Is One of the Many Species of Jellyfish Found in the Gulf; Below, Large Sawfish Caught in Shrimp Trawl Net by Fishermen in the Gulf of Mexico

furnishes a real fight when hooked on rod and reel.

Frequently the waters among the islands off Biloxi are suddenly disturbed by the leap of the leopard ray, known to scientists as spotted ray. It reaches a size of ten feet. Flat and shaped somewhat like a kite, it has a powerful arrangement of teeth in crushing-mill fashion. Then there is the great ray, truly one of the queer fishes. Called the manta, giant ray, sea devil, sea bat and other names, they have been known to attain a weight of 8,000 pounds. One day, while en route from Main Pass to Breton island, the lookout on a yacht sighted more than twenty of these strange creatures lolling atop the water. From head to tail, they measured eighteen feet, while across they were about twenty feet.

In Central America the Spanish name of "manta" was given them, meaning blanket.



Top, Gulf Game Fish, Including Jackfish at Each End, Three Large Redfish or Channel Bass in the Center and Three Smaller Blackfish; Bottom, Fishermen Repair Nets Torn by Sawfish

Divers in the tropics avoid the manta, holding to the traditional story that the giant ray will engulf a man and slowly devour him. Such, however, seems to be mythology. The manta is dangerous when wounded and can be taken only by harpoon after a hard battle of several hours.

The cow fish has a coat of armor consisting of hardened scales which form a bony box from which the jaws, fins and tail can be moved freely. The name is applied because of small horns in front of its eyes. The porcupine fish is one of the most grotesque members of the finny tribe, being of olive color and spotted with black dots. Armed with sharp-pointed spines, it is difficult to handle without being injured. Like blow fish, which also are found in the Gulf, porcupine fish are capable of inhaling air or water to form a balloon-like appearance to frighten enemies.

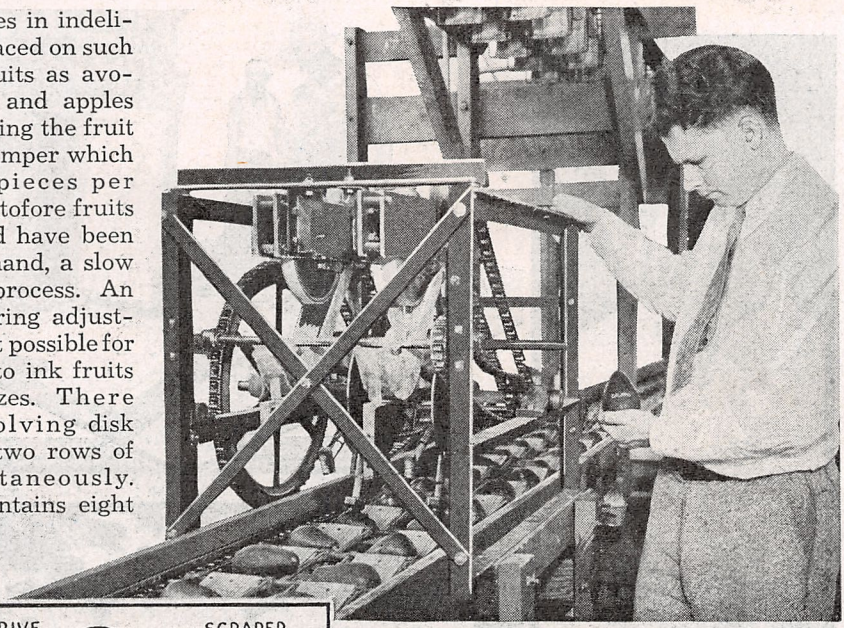
Although a small fish, generally running about six or seven inches in size, the bat fish looks the least of any like a fish. It appears to be a toad, but has spine-like scales and a spinous dorsal fin.

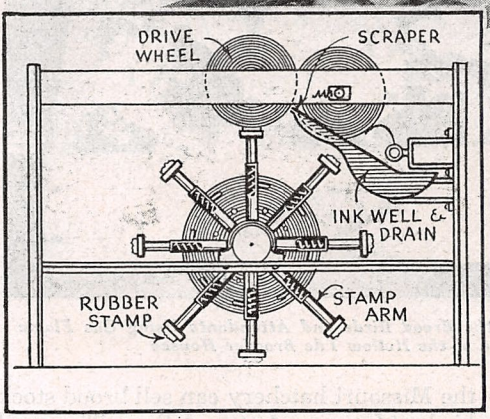
While the drum fish is not exactly a queer specimen, its powerful jaws hold a set of mill-like teeth with remarkable crushing force. Schools of drums, from

(Continued to page 120A)

Stamper "Walks" over Fruit without Bruising

Trade names in indelible ink are placed on such perishable fruits as avocados, pears and apples without bruising the fruit by using a stamper which handles 125 pieces per minute. Heretofore fruits easily bruised have been stamped by hand, a slow and tedious process. An automatic spring adjustment makes it possible for the stamper to ink fruits of various sizes. There are two revolving disk sets serving two rows of fruit simultaneously. Each disk contains eight



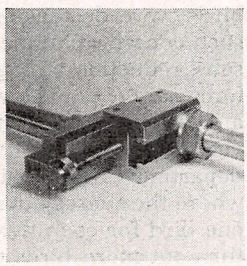


Stamping Machine Which "Walks" over Fruit and Diagram Showing the Method of Operation

arms, each being set into a tube against a spring which holds the arm at full length. A telescoping plunger takes care of the large fruit by shortening the radius of the stamp arm as it passes over the fruit. A rubber stamp is attached to each arm, ink is placed in a sheet-metal well and a light spring steel paddle carries the ink from the well to the face of the inking wheels as the latter revolve on a spring tension bearing. A light spring scraper removes surplus ink and the rubber stamp arms on the assembly wheels in rotation press against the inking wheel and then pass over the fruit as it travels along below in canvas baskets. The arms are spaced to meet every piece of fruit in the center of its basket, the stamper printing the name as it "walks" over the fruit. There is pressure enough to leave a clear impression.

BORING BAR MADE ADJUSTABLE TO INCREASE ACCURACY

Greater accuracy is obtained for a boring bar by designing it with an adjustable head. A shank permits attachment to the machine on which the tool is to be used. A micrometer screw and the graduated head give accuracy of settings. The tool can be adjusted quickly and locked rigidly when boring. It is offered as a time saver in machine shops.



¶Cellophane is being used for coin wrappers, enabling bank tellers to count the money without unwrapping the rolls.

Bobwhite Farm Raises Quail Like Chickens

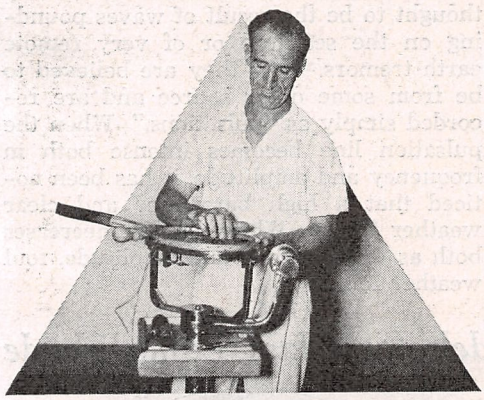
Baby Quail Hatched on a Bobwhite Farm, One of the Brood Birds and Attendants Using Gas Flame Torches to Sterilize Equipment in One of the Hollow Tile Brooder Houses

Factory production of bobwhites is being followed by a Missouri quail hatchery now turning out 500 birds per week. The quail farm was started because it was found the birds were decreasing in number despite such conservation measures as closed seasons, reduction of bag limits and rigid enforcement of game laws. The farm now has a production capacity of 10,000 birds per year which are delivered to state game departments for restocking. In Missouri where the average density of quail is about one bird for each five acres, the plant can turn out more birds than would be found on 50,000 acres. Heretofore where attempts had been made to raise quail on state experimental farms, the average cost per bird produced was about three dollars, but the Missouri hatchery can sell brood stock birds at from one to two dollars. The quail plant covers 140 acres. Eggs are produced by 250 pairs of wild trapped birds or birds reared from eggs gathered in the Ozarks. Each pair has its own breeding pen, protected by a high wire fence from cats, dogs or other trespassers. The birds are fed a scientifically balanced ration which speeds up production to about five dozen eggs during the summer season instead of the fifteen to twenty-five usually laid by a wild quail. One bird laid 171 in one season and more than 100 eggs from one bird are not common. The baby birds are hatched in electric incubators, each equipped with double units for control of heat, humidity and air circulation, so that

if one fails the second is switched on automatically. Gas flame torches instead of chemical washes and dustings are used to sterilize hatchery equipment and all feeding trays are sterilized daily. Hollow tile was found best suited for brooder houses, each of which is equipped with an electric mothering unit with thermostat control to protect the baby birds from drafts. Later the birds are placed in exercising pens of wire netting where they are kept until transferred to the wilds, where landowners agree no shooting will be permitted through the next two seasons to allow them time to mature.

STRINGER FOR TENNIS RACKET IS EASY TO OPERATE

So simple in operation that anyone can operate it, a new machine for stringing tennis rackets is being offered as a substitute for hand work. The stringing device

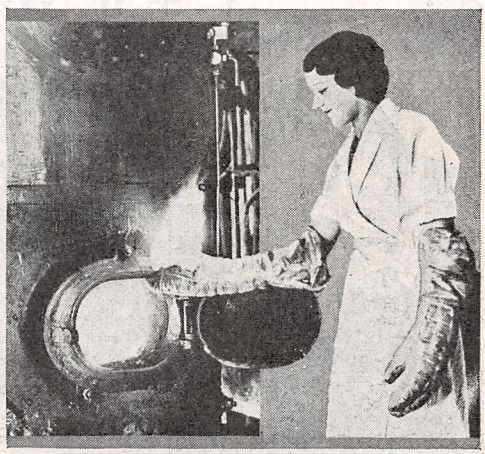


Simple Apparatus for Stringing Tennis Rackets Does the Job with Precision

substitutes precision methods for human judgment on tension of the strings, doing the job exactly the same each time. The average player, with the aid of the machine, can take care of his own racket, and possibly those of his friends, turning out work similar to that of professionals.

FIREPROOF GLOVES ARE ADDED TO FLYER'S EQUIPMENT

Fireproof gloves have been added to the equipment of the British Royal Air forces for use in fighting the flames when a ship catches afire. The gloves adopted were found in tests to withstand terrific heat

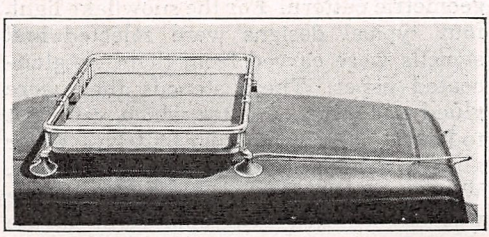


Testing Fireproof Gloves by Picking a Live Coal from the Inside of a Blazing Furnace

without scorching. The tests included picking blazing coal from a furnace with the gloves, grasping a red-hot steel bar, holding the gloved hand in the heat of a forge fire for thirty seconds and bending a red-hot steel bar placed in a vise.

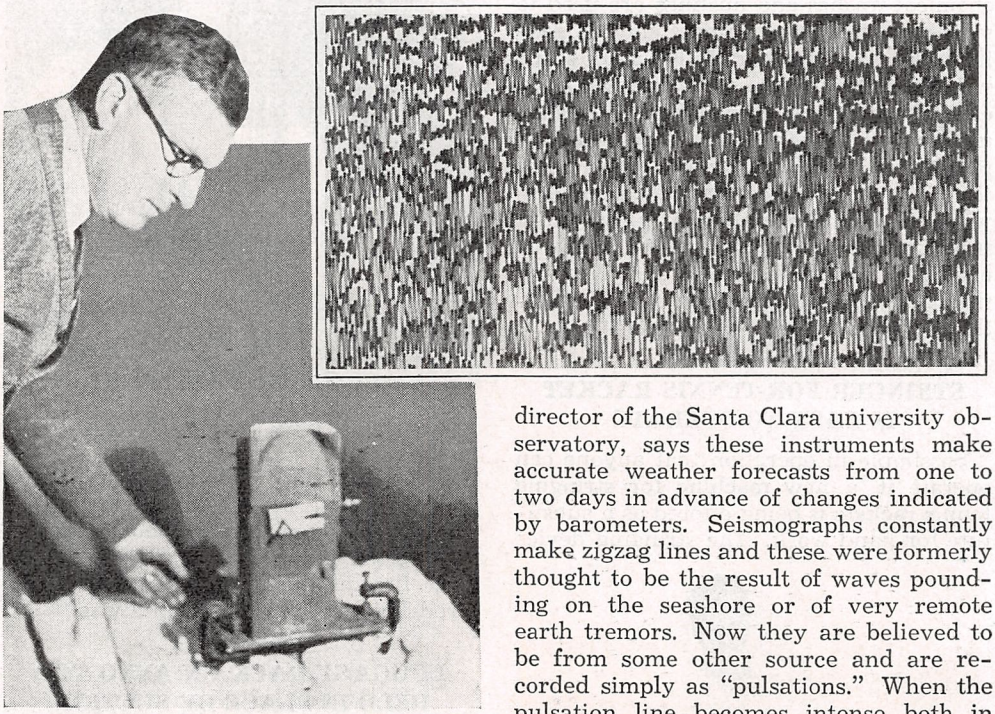
LUGGAGE RACK ON AUTO TOP HELD IN PLACE BY SUCTION

Suitcases, camping equipment and other bulky articles can be stowed on top of the car if the auto is equipped with a luggage carrier which attaches to the top with suction-cup grips. It consists of a tubular steel vacuum storage-tank frame with large rubber suction cups at each corner. These cups hold the carrier in place by vacuum from the motor supplied through a section of tubing connected to the windshield wiper. When the motor is shut off check valves in the rubber cups and frames maintain suction to hold the carrier in place. The carrier will hold several suitcases. It can be converted into a table by attaching legs at the four corners.



Suction Cups at Each Corner Hold Luggage Rack; Motor Supplies Vacuum for the Cups

Seismograph Tells Weather by "Pulsations"

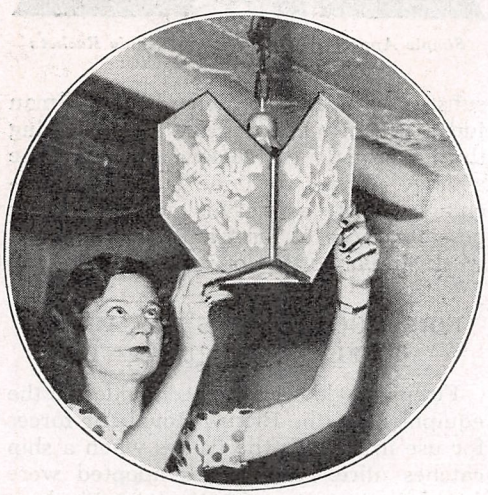


Seismograph Recorder and Lines Made by It from Which Weather Forecasts Can Be Made

Seismographs, long used to record earthquake tremors, have also been found to forecast the weather. Dr. Albert J. Newlin, director of the Santa Clara university observatory, says these instruments make accurate weather forecasts from one to two days in advance of changes indicated by barometers. Seismographs constantly make zigzag lines and these were formerly thought to be the result of waves pounding on the seashore or of very remote earth tremors. Now they are believed to be from some other source and are recorded simply as "pulsations." When the pulsation line becomes intense both in frequency and amplitude, it has been noticed that a high barometer and clear weather follow. When the line decreases both as to frequency and amplitude, foul weather follows.

Snowflakes Are Used as Models for Glass Lamp Shade

Enlarged microphotographs of snowflakes provide the geometric designs for a glass ceiling lamp consisting of three plates of glass joined by metal strips to form the sides and a smaller triangular piece, also with a snowflake design, for the bottom. Snowflakes are intricate aggregations of ice crystals which always build up into a geometric pattern. For the snowflake light, four typical designs were selected and stencils were carved from them on glue-coated paper. These stencils then were glued to the glass plates which were cut to hexagonal or triangular patterns. Clear glass with a flashed opal surface was used. With a sand blast, the design of the flake was cut through each opal layer to the clear glass, resulting in an opal-white flake in relief upon a ground-glass background.



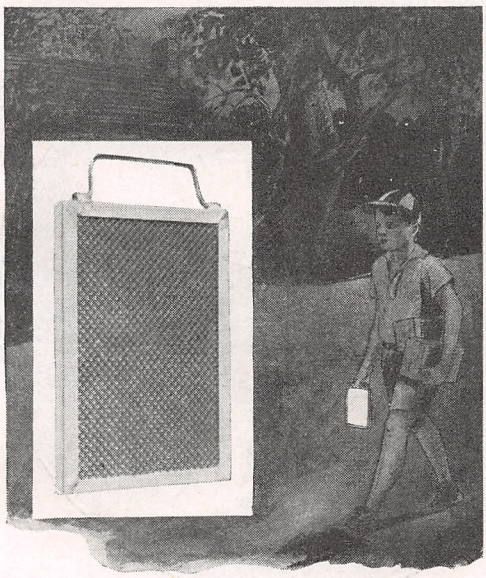
Lamp Shade with Designs Copied from Snowflakes

SHIP STOPS PROPELLER "SHAKE" WITH JUMPING WEIGHTS

When the propeller of a ship turns at high speed and slaps the water, it makes something shake and there is no way of deadening the shock with springs. Shipbuilders, however, are counteracting propeller vibration by creating a new vibration of about the same force to offset it. A weight about equal to that of a trolley car is suspended on a beam in the center of the ship, and is made to vibrate up and down by machinery which can be controlled to conform to the speed of the propeller. When this weight attains a certain speed of vibration it crosses out the propeller "shake," and the two exactly counteract each other.

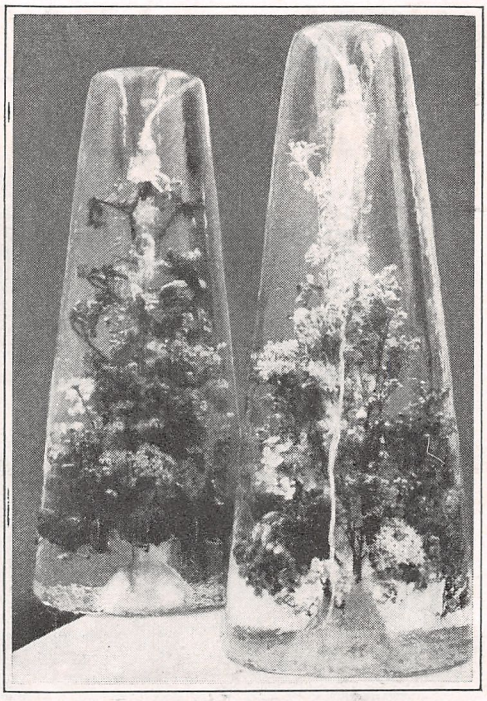
REFLECTORS FOR PEDESTRIANS WARN MOTORISTS AT NIGHT

Pedestrians walking along highways at night can warn motorists of their presence by carrying small reflectors of metal



Child Is Shown Carrying Reflector to Warn Approaching Autos; Inset, the Reflector

and glass. It consists of a rectangular metal frame with a reflector between two pieces of glass and a handle for carrying. The reflector picks up and throws back the light from car headlamps long before the driver can see the person who is carrying the safety device.



Native Plants Make the Trip from Australia to London Encased in Molds of Ice

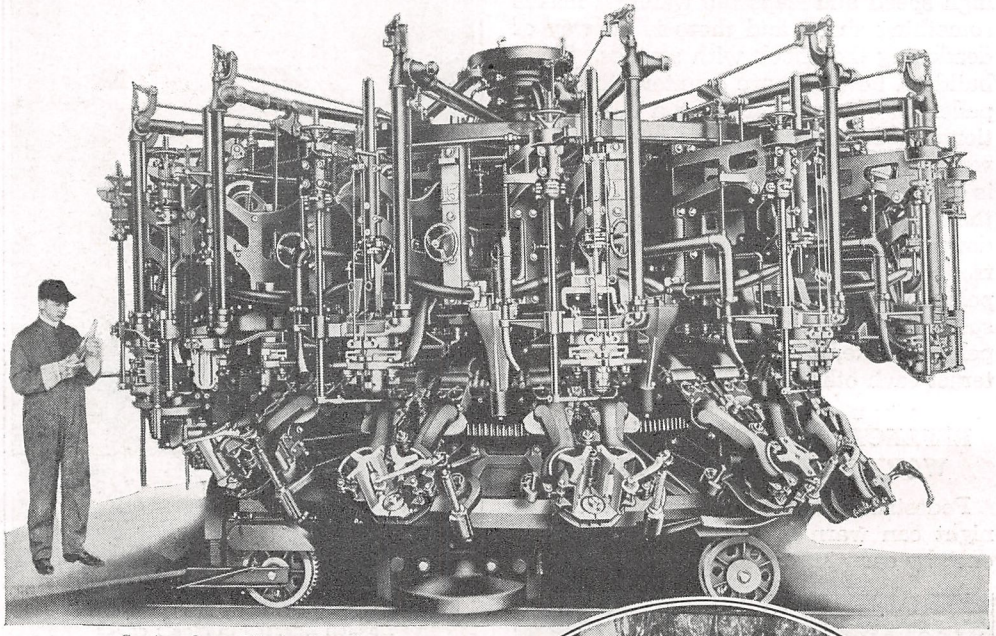
FLOWERS FROZEN IN ICE MOLDS KEEP FRESH WHEN SHIPPED

Shipped in frozen molds, native flowers retain all their original fragrance on the long trip from Australia to London, keeping fresh for weeks. Before being placed aboard ship, the flowers are packed in molds, which then are frozen.

PAINT GLOWS IN "BLACK LIGHT" OF ULTRA-VIOLET LAMP

Fluorescent paint that glows in the invisible light of an ultra-violet lamp is now on the market. Under ordinary illumination, the paint resembles other paint, but under the ultra-violet ray, it emits brilliant light of any desired color. Objects not coated with the paint disappear in the background. The product lends itself to decoration of objects, walls or windows in the home, to creation of luminous spectacles on the stage, to production of unusual effects on paintings, sketches and murals, and to many other purposes. A special cold cathode tube is recommended to get best results with the paint.

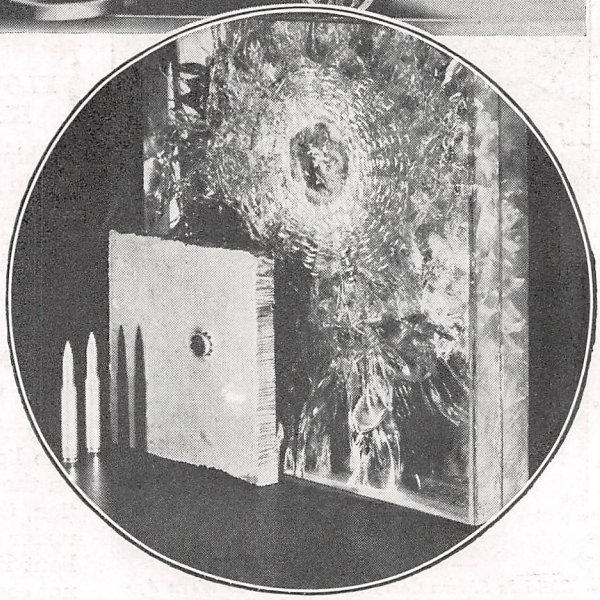
The WONDERS



Courtesy Owens-Illinois Glass Co.

GLASS as heavy as iron and spun as fine as silk, glass that stops X-rays like lead, glass as strong as wrought iron, glass that can be heated red hot and plunged into ice water without breaking, glass that is used like pipes to conduct fluids, glass that looks like diamonds—these are some of the triumphs of modern industry.

Although glass has been known a long time and is even found in nature as obsidian, a black opaque glass, it has remained for the scientist to show us what man can do. "As brittle as glass" is an old saying which cannot be said to be truthful any more. In fact, glass will maintain its shape under pressure which will make metals bend like putty.



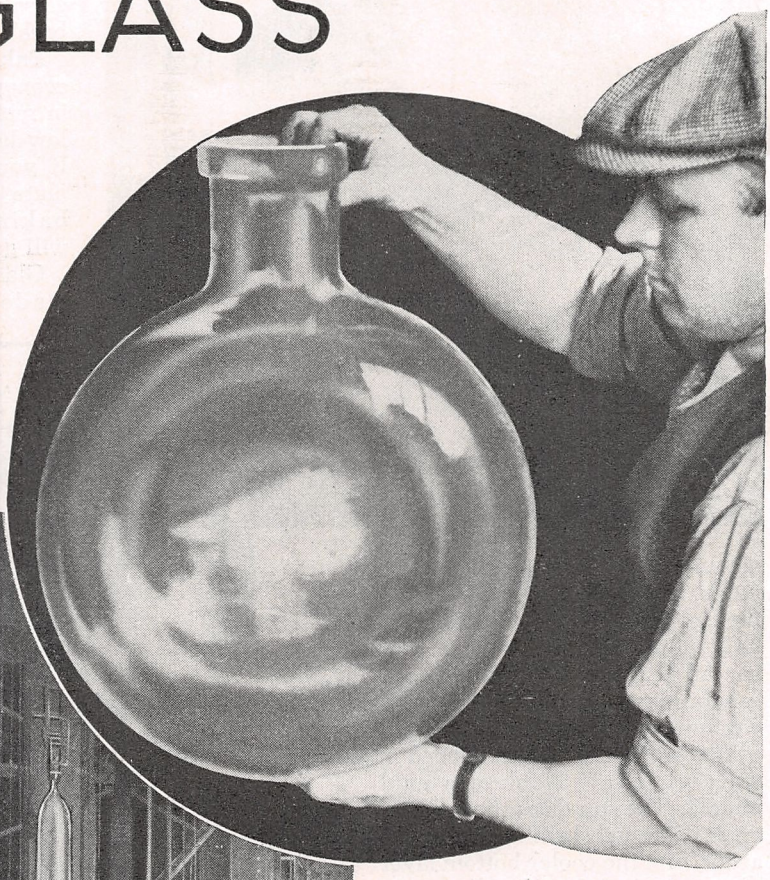
Courtesy Pittsburgh Plate Glass Co.

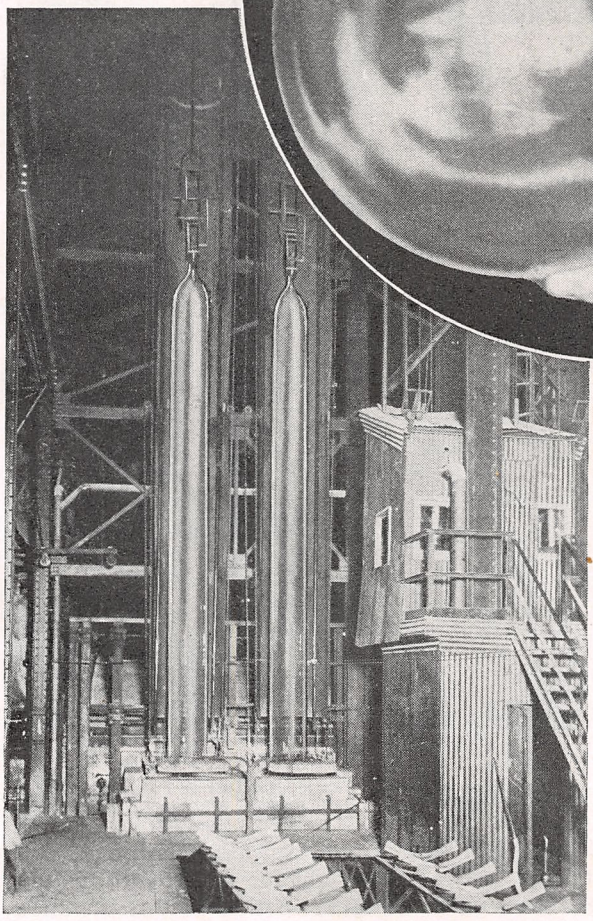
Top, Scene in Glass Factory; Bottom, Bullet Pierces Boiler Plate (Left) but Not the Glass

This is hard to believe but tests at the Corning glass factory, where every kind of glass from bottle glass to that used in the new two-hundred-inch mirror of the world's largest telescope is made, show that this is true. The resistance of glass to crushing is extremely great. It would take about eight loaded freight cars weighing about 350 tons, or 700,000 pounds, to crush a two-inch cube of hard glass. Even

# of GLASS

Right, Large Flask for Use in Laboratory Is Made of Glass Which Resists Sudden Heating or Cooling; Such Glass Is a Boon to the Chemist Because It Permits Him to Complete Many Experiments That Might Fail If Test Tubes Should Break



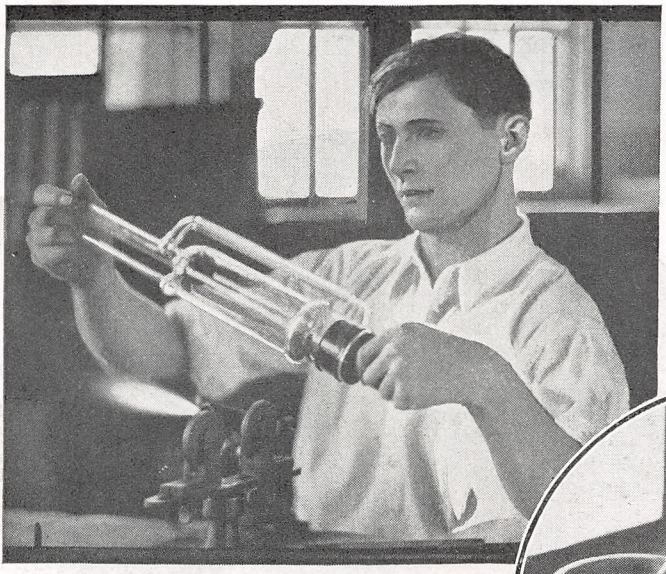


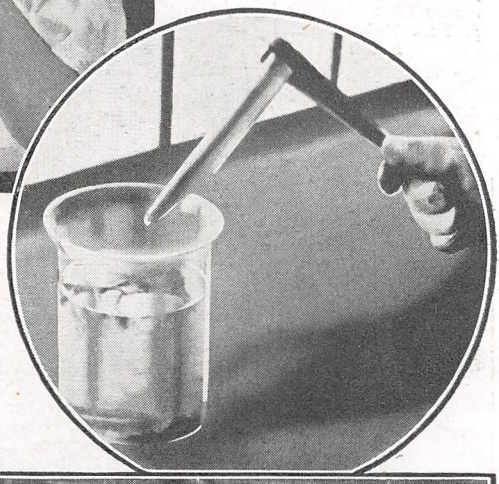
Large Cylinders of Glass Are Drawn and Split in the Manufacture of Huge Panes

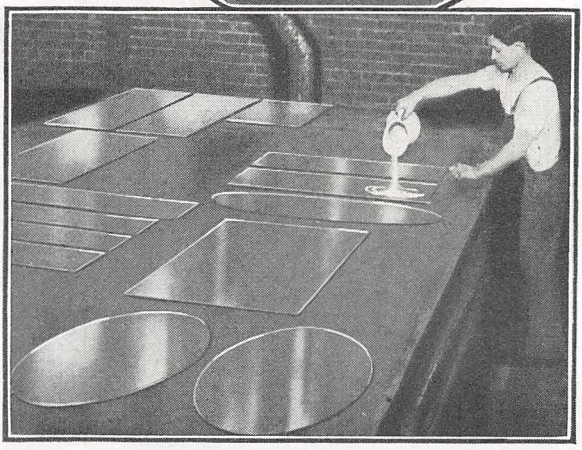
cast iron will yield before this hard glass.

There are three main kinds of glass. There is the soda-lime variety which goes to make up bottles and window panes. Sand, lime and carbonate of soda, the ordinary washing soda, go into such uses. Lead glass contains lead salts instead of lime. The cut glass, so popular twenty years ago, was lead glass which has great brilliance and can be given a high polish. Glass can be made with so much lead in it that its weight will be equal to that of grey cast iron. Such glass can be used to protect X-ray technicians against the dangerous effects of these rays.

All transparent objects bend light in greater degree and this







Courtesy Pittsburgh Plate Glass Co.

Top, Glass-Blowing; Center, Hot Quartz Tube Does Not Crack in Cold Water; Bottom, Silvering Mirrors

pies and custards in some glass dishes without fear of breakage.

Baking can be done more economically in glass than in metal because glass has low heat reflecting power. If you will place a glass plate under an aluminum baking dish, the baking will go faster.

Glasses of all kinds are made today, including those that will transmit only the invisible ultra-violet light for taking pictures in a dark room; those that will stop bullets, and glasses so thin that they will be broken by the breath.

amount of bending is called the refractive index. The more light is bent, the greater the sparkle. The index of a diamond is 2.42, quite high, while the best lead glass has an index of 2.00. So, even today, we cannot manufacture the diamond although we imitate it closely.

Why does a hot bottle placed in ice cold water break? Think of a mud puddle. The sun dries the top layer. It dries and shrinks and breaks away from the cooler bottom layer of water which hasn't changed its shape. The same thing happens to a glass dish or bottle which is placed hot into cold water. As the surface layer of glass cools and tries to shrink to its normal shape, it breaks away from the bottom layers and the glass cracks. Some glass made from certain forms of silica can be heated white hot, plunged into cold water and remain unbroken. Why? This brings us to the third form of glass.

Borax or boric acid when mixed into glass gives it the property of expanding very little when hot and consequently contracting little when cooled. This means little shrinkage. Glass made of such a composition is therefore not subject to the stresses that break ordinary glass when cooled or heated suddenly. That is why you can bake

Collection of Poster Stamps Is the Latest Fad

Some Examples of Poster Stamps Collected as Hobby; Right, Stamps Are Kept in Book Like Those Used for Postage Stamps

Poster-stamp collection is the latest fad to make its appeal to the thousands of men, women and children who make a hobby of collecting and classifying everything from postage stamps to match books and picture post cards. Poster stamps are the stickers and labels used to commemorate some event or to advertise or attract attention to some commercial product. The hobby costs virtually nothing since the source of such labels is almost endless. Hotel baggage labels, stamps advertising conventions, fairs and expositions, safety-first stickers, and the hundreds of varieties of labels used on manufactured products are only a few of the possibilities. The hobby has a definite educational value if stamps calling attention to historic events are collected. The collection is preserved in stamp books like those used for postage stamps and many collectors obtain foreign stickers by trading with collectors in other countries. Usually related subjects are segregated in each collection and finally a collector becomes interested in one particular form of poster stamp and concentrates on obtaining a complete file of such stickers.

PAINT CAN HAS WIRE MIXER FOR USE BEFORE OPENING

Paint can be mixed inside a new-type can equipped with a mixing paddle and handle that folds flat against the can when not in use. Before the can is opened, the wire handle is operated to stir the paint, eliminating the possibility of losing part of the contents over the sides of the can while mixing in the ordinary manner. The metal handle also aids in opening the can.

Theater Employes Wearing Cardboard Heads of Motion-Picture Actors as a Means of Advertising; Note Close Resemblance to the Actors

CARDBOARD HEADS OF ACTORS WORN TO ADVERTISE FILM

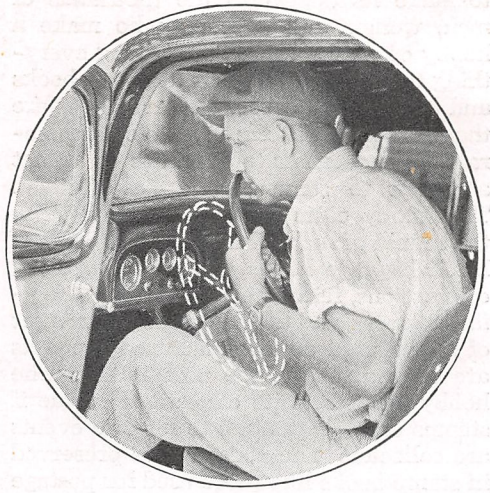
Giant cardboard heads of motion-picture actors were worn in a parade recently to advertise a San Francisco theater. The heads were naturally colored and made to resemble closely the actors. Transparent colored gauze in the necks enabled the wearers to see where they were going.

AIR-DRIVEN SAW CUTS PILING BENEATH THE WATER

Operation of machinery under water has always been difficult because powering such a machine offered a problem. A chain-type sawing tool is being used, however, in cutting piling off under water and doing similar work, compressed air furnishing the power. This tool, operated by two men, is made up of a supporting member composed of saw steel in laminated form, a slot being left around the outer edge of the oval support for the links of the endless-chain saw to travel. Such a tool has operated seventy feet under water, but it is not limited to such work for it is also built with an electric drive and then can be used for cutting heavy timber in shipbuilding operations and in felling big trees. It eliminates the ax in felling trees, for the wedge-shaped portion usually chipped out with the ax is sawed out with two cuts of this saw after which the felling cut is made on the opposite side of the tree.

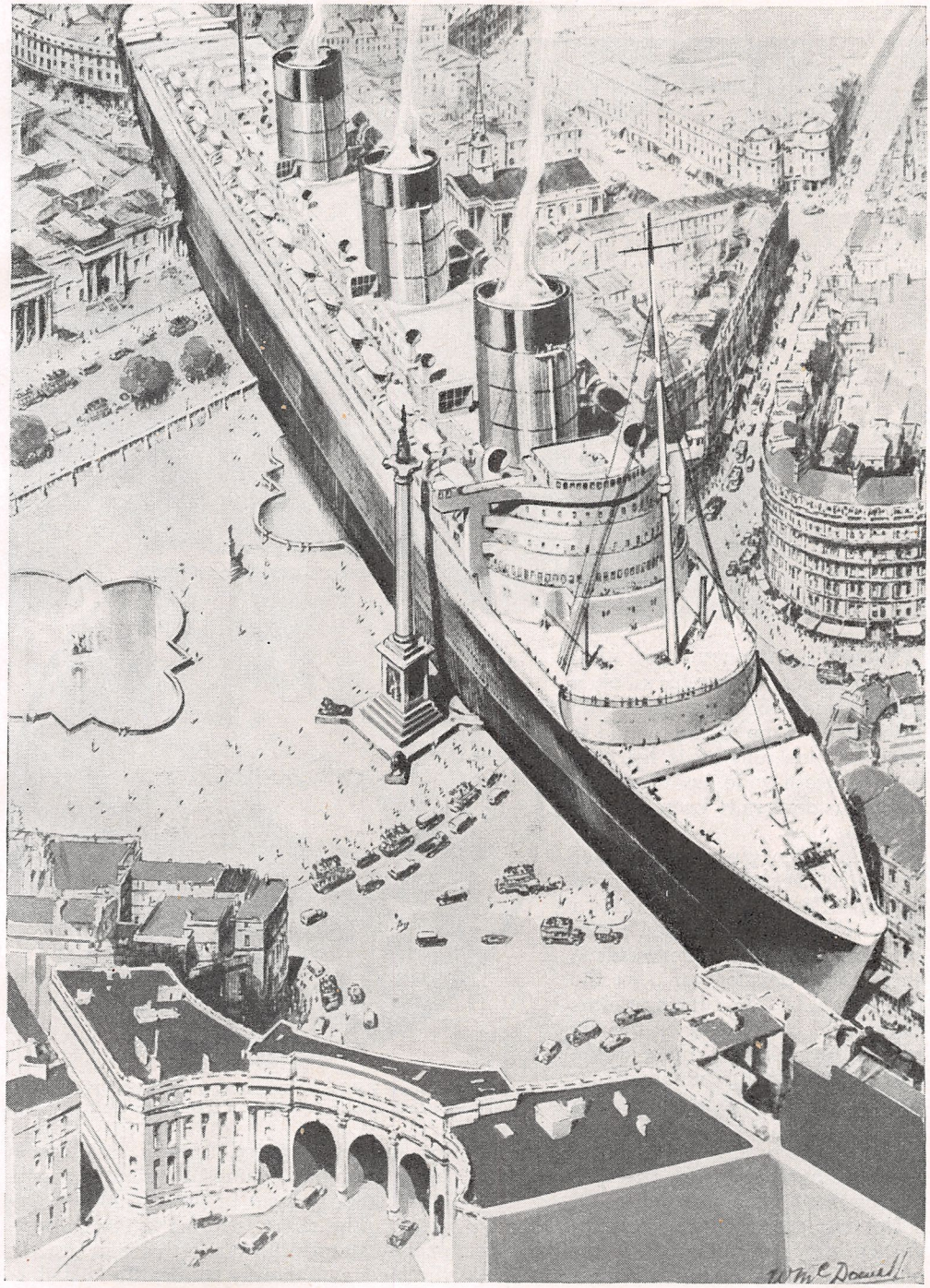
STEERING WHEEL HAS SPRING POST

New safety for the automobile driver is the purpose for which a spring-equipped steering post has been designed. In case of an accident, the spring permits the post to shorten, providing a space of several inches for part of the shock to be absorbed before the driver's body is forced against the steering wheel. In addition, the level of the wheel is lowered as the spring gives, reducing the hazard of the driver's head striking the wheel. Under ordinary driving conditions, the spring-equipped wheel turns the wheels easily. The slight springiness in the post is believed to eliminate some of the fatigue of long trips, since much shock transmitted from the wheels would be absorbed.



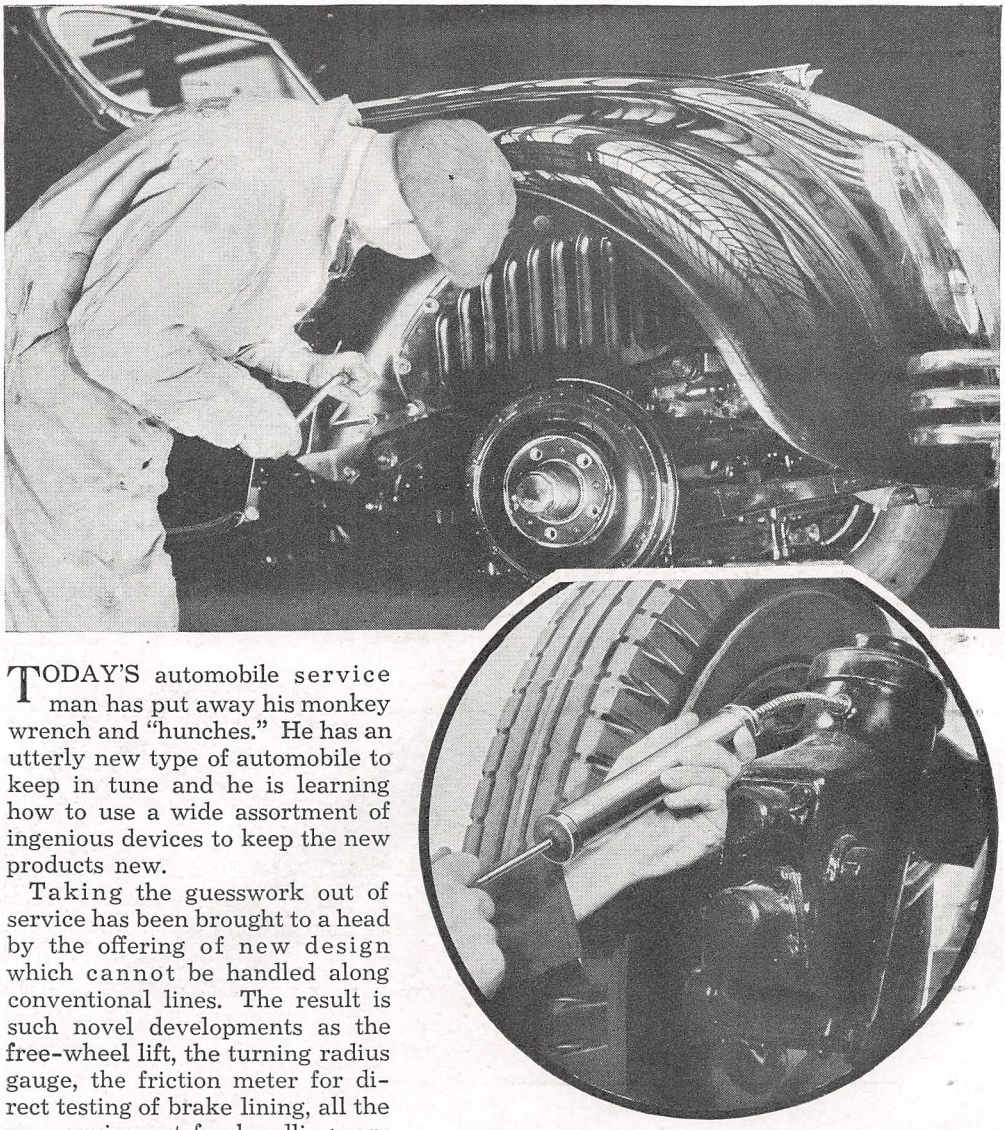
Driver Holding Collapsible Steering Wheel; Dotted Lines Show How Far Post Lowers

Giant British Liner Dwarfs Large Buildings



Drawing Shows How Cunard White Star Steamship "No. 534" Would Appear if Placed in Trafalgar Square, London, with Bow Cutting into Whitehall and Stern at Garrick Theater, 1,020 Feet Distant

SERVICING



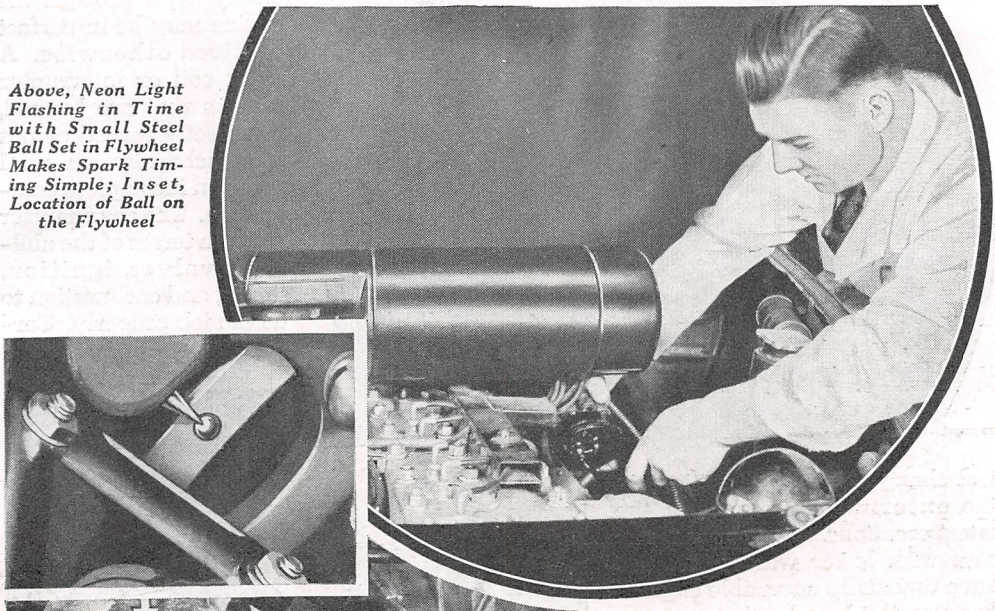
TODAY'S automobile service man has put away his monkey wrench and "hunches." He has an utterly new type of automobile to keep in tune and he is learning how to use a wide assortment of ingenious devices to keep the new products new.

Taking the guesswork out of service has been brought to a head by the offering of new design which cannot be handled along conventional lines. The result is such novel developments as the free-wheel lift, the turning radius gauge, the friction meter for direct testing of brake lining, all the new equipment for handling cars with knee action and even such timely devices as a special curb jack for cars with low splash pans, overhanging bumpers and independently sprung front wheels.

Top, Reaching Valves by Removing Plate under Fender; Bottom, Adding Fluid to Knee-Action Unit

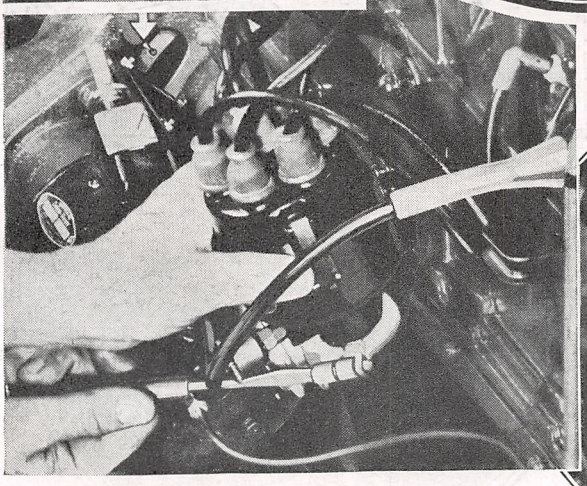
Not only are engines being tested for accuracy of spark timing while they are in operation but a highly advanced system utilizes a neon light for checking ignition. Each time the spark plug of a cylinder of an engine so tested fires, a small neon lamp, flashing in time, illuminates a polished steel ball set in the rim of the flywheel. The effect is to make the ball appear to stand still. While this is in process the mechanic merely rotates the distributor until the ball appears directly in line with the pointer. Timing, by this method,

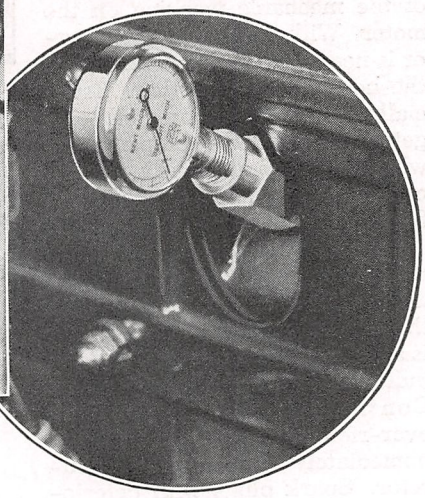
the NEW CARS



Above, Neon Light Flashing in Time with Small Steel Ball Set in Flywheel Makes Spark Timing Simple; Inset, Location of Ball on the Flywheel

Above, Hood Lifts as Complete Unit to Give Easy Access to Modern Motor



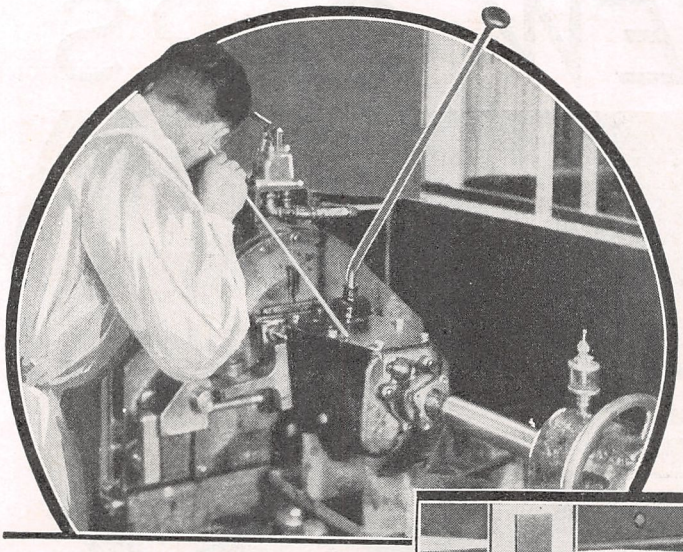


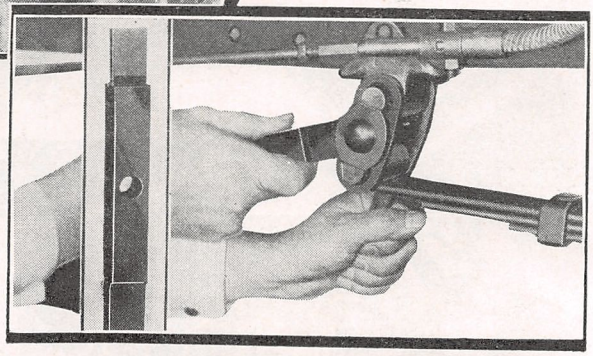
Compression Gauge, Shown in Place, Replaces Method of "Feeling" Resistance to Hand Cranking

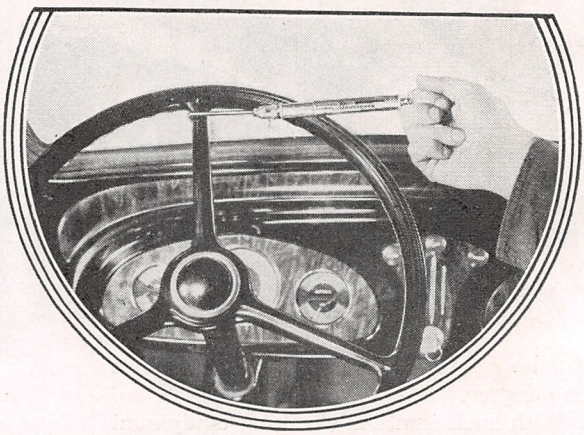
can be set to an accuracy of one-half of one degree.

With such ignition-checking equipment a spark timing adjustment can be made in less than five minutes, thus assuring the owner better results from his motor and encouraging car designers to continue with their efforts to fashion cars critical in their adjustments. This process is similar to the stroboscopic effect obtained with a bank of electric lights set to flash in time with any moving part of the car. Where such equipment is used it is possible to see exactly how the engine's valves behave when operating at high speed. Any tendency toward stickage is quickly detected. Weak valve springs immediately show up.

Revolutionary methods of servicing the newer cars are due, not merely to mechan-







Top, Stethoscope Used to Detect Transmission Noises; Center, Gauge for Self-Adjusting Shackles; Bottom, Gauge Tests Effort Required to Turn Steering Wheel

charge being ignited too soon or too late, causing a marked loss of efficiency even though the engine may be in perfect condition otherwise. A weak coil or interrupter points that are burned, incorrectly spaced or out of synchronization will result in incomplete combustion. The gas analyzer reads in terms of the ability of valves, ignition, timing and carburetion to do the job properly. Carburetion is considered last because it is usually least to blame.

ical changes, but to alterations in the external appearance of the latest creations. Two of the latest cars with lower wind resistance have unusually accessible engines because the hood raises as one piece and lifts well out of the way of the mechanic working on the motor. With these cars it no longer is necessary to drop one side of the hood to lift the other. Especially interesting is the method of getting at the valve compartment, which is reached by removing a cover plate under the right front fender.

Carburetor adjustments are now being amplified by checking the quality of exhaust gases. With the engine running, the analyzer is attached to the tail pipe and the indicator is watched carefully. Contrary to popular belief an over-rich mixture is not viewed immediately as due to the carburetor. Spark plugs with deteriorated points that greatly increase the gap, for instance, cannot burn the standard charge of fuel as introduced by a correctly adjusted carburetor. If gum formations prevent valves from seating properly, fuel cannot be compressed to the desired explosive limit and the exhaust will show too much unburned fuel. Incorrect timing results in the gas

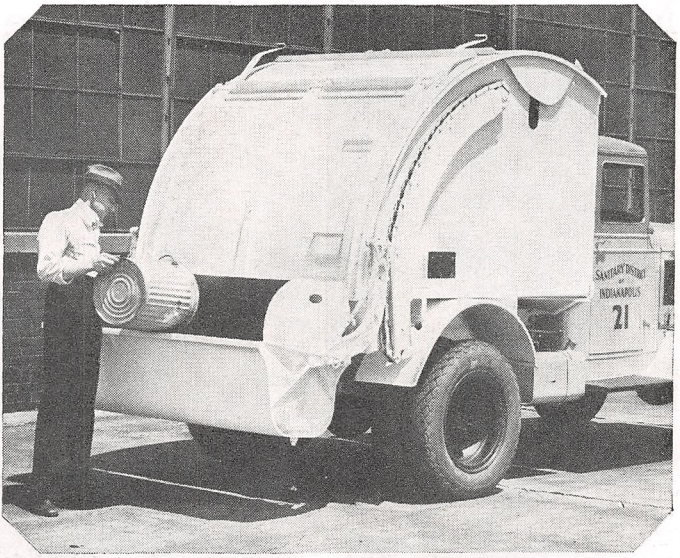
Because the modern fuel pump is such an important feature of any motor's efficiency many service men are now using a special pump analyzer with a gauge giving precision reading at as low pressures

as one to five pounds per square inch. All tests are made under actual operating conditions.

Testing the efficiency of spark plugs while they are in operation on the engine is another of the modern steps in service. Unique among the new devices is one that sways the car from side to side while it is being lubricated. Since this imitates actual driving conditions over a rough road it is a short cut to the cause of squeaks.

An amazing amount of new equipment has come on the market to provide ways of keeping cars in alinement. Axle presses, frame straighteners, wheel balancers, wheel aliners and tracking gauges are among the assortment of devices to keep

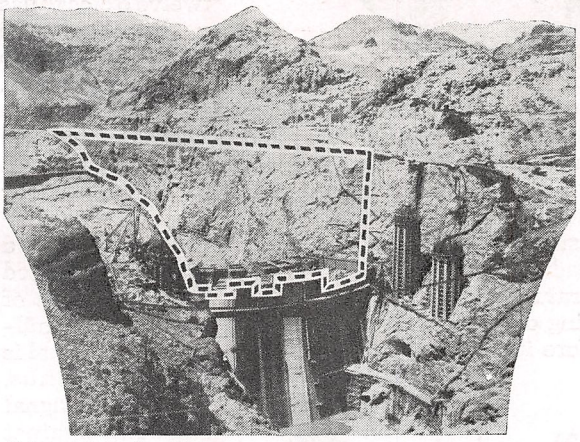
(Continued to page 128A)



Emptying Garbage Can into Loading Receptacle; the Larger Garbage Container Is Water and Air Tight, Preventing Escape of Odors

BOULDER DAM RISES RAPIDLY FAR AHEAD OF SCHEDULE

Two years ahead of its scheduled progress, Boulder Dam is rising rapidly. More than 460 feet of concrete have been poured above the foundation, with the completed dam to be 267 feet higher.



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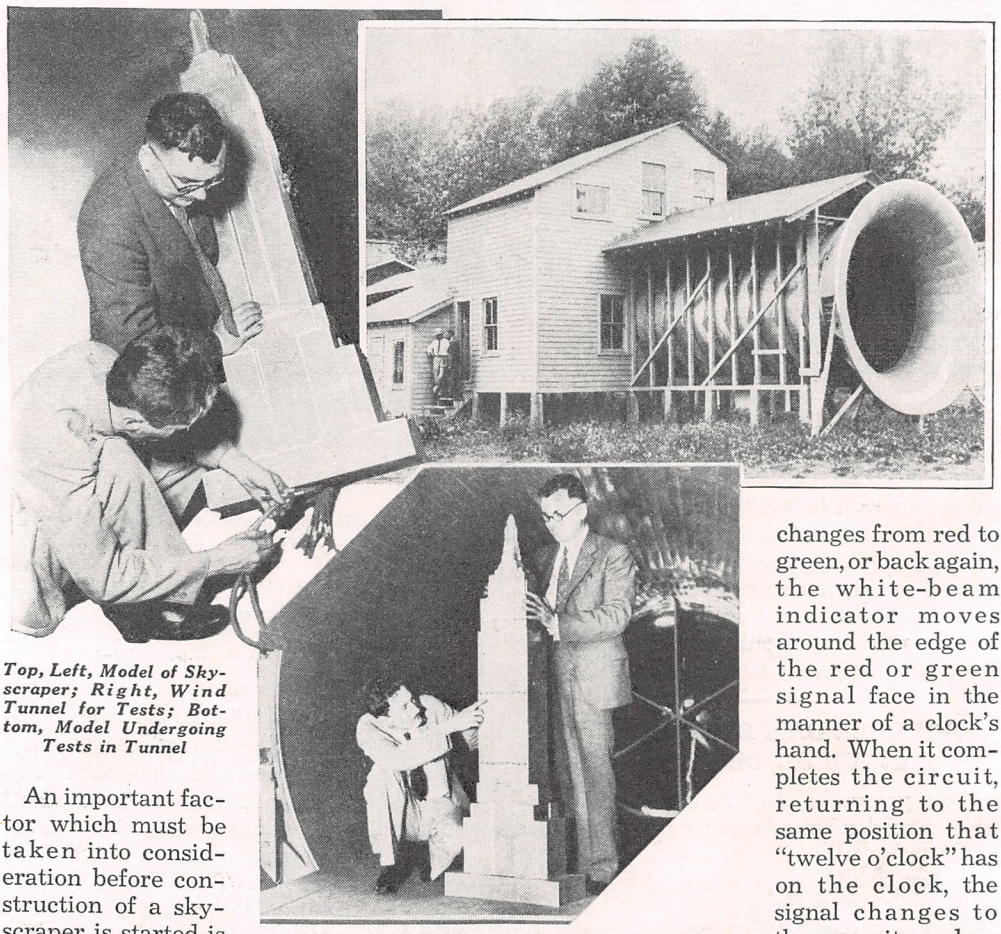
Dotted Line Shows Work Yet to Be Done on Boulder Dam, While Below Is the Completed Section

ODORLESS GARBAGE TRUCK IS MORE SANITARY

Garbage collection trucks which do not advertise their presence by their odor are being operated in Indianapolis. The truck itself drives through all four wheels, has a rated capacity of one and one-half to two tons and is equipped with both standard and auxiliary transmissions, giving it a total of eight forward speeds and two reverse. The body is operated hydraulically by the truck engine. On the rear is a loading receptacle holding three-fourths of a cubic yard. When it is filled, it is automatically raised to the top of the body and dumped in the main compartment which has a capacity of six cubic yards. The entire body is both water and air tight. When closed, there is no odor. The entire body is raised by a slant type hydraulic hoist for emptying the main compartment.

¶Popular Mechanics Magazine does not publish the name of the maker of, or dealer in, any device described in its pages, but this information will be furnished by our Bureau of Information upon request, accompanied by stamped, self-addressed envelope.

Models Show Wind Resistance of Skyscrapers

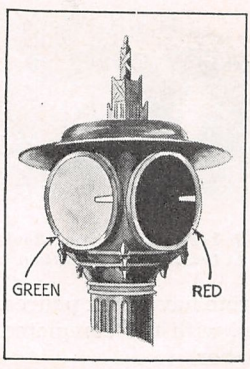


Top, Left, Model of Skyscraper; Right, Wind Tunnel for Tests; Bottom, Model Undergoing Tests in Tunnel

An important factor which must be taken into consideration before construction of a skyscraper is started is wind resistance. To determine this accurately, models of skyscrapers are made and tested in a big wind tunnel at the bureau of standards in Washington. The resistance to the air as it blows against the upper part of the building is then measured by means of small rubber pipes leading from the model to registering apparatus. In this manner the swaying or rocking of any building can be determined before it is built and changes made in plans.

TIME BEAM IN TRAFFIC SIGNAL WARNS OF LIGHT CHANGES

Accurate timing of stop and go periods at street intersections is accomplished in an economical traffic signal equipped with a white timing beam. As the traffic light changes from red to green, or back again, the white-beam indicator moves around the edge of the red or green signal face in the manner of a clock's hand. When it completes the circuit, returning to the same position that "twelve o'clock" has on the clock, the signal changes to the opposite color. By watching the moving white beam, automobile drivers and pedestrians time the period remaining before the signal will change. The signal lamp has only four faces, one in each direction, instead of the twelve used in some types of signals. The familiar amber signal is eliminated. Thus, with the red signal showing against north and south traffic, the green light permits traffic east and west. One bulb lights the signal lamp.



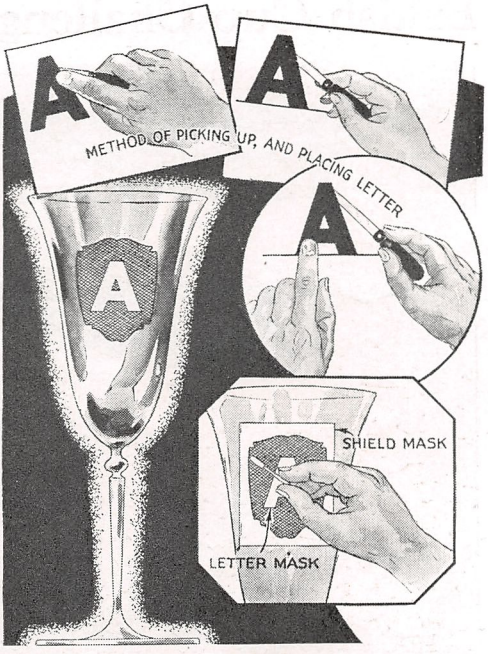
LAWN ROLLER WITH SPIKES IMPROVES THE GRASS

Lawns and golf courses can be kept in condition with the aid of a hollow spike roller which can be operated by hand or by power. It is equipped with hollow spikes two inches long and three-fourths of an inch in circumference at one end, tapering to one-half inch. As the roller moves over the turf, the spikes cut a plug of soil which is deposited inside the roller as it revolves. A clean-cut depression is left in the ground and the soil is removed in such a manner that none is spilled over the grass. When the container is filled, it is emptied by removing side plates. Following the use of the roller, top dressing and fertilizer are applied, these reaching the roots, where they will do the most good, through the spike holes. It is also claimed the roller tends to make the turf springy and the depressions enable water to penetrate more easily.

Roller with Spikes Cuts Small Holes in Lawn to Make Cultivation of Grass Easy

MONOGRAMS ETCHED ON GLASS BY EASY METHOD

Letters and numbers can be etched on beverage sets and other glassware by an easy method devised for use in the home. It consists of cementing prepared letters

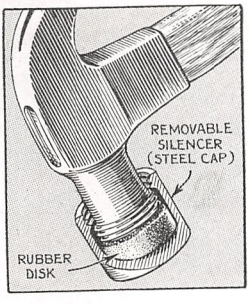


Four Steps in Etching Monogram on Glass; Left, Beverage Glass with the Monogram in Place

and numbers on the glass, followed by the application of a special etching cream. The process requires only about five minutes for the etching cream to take effect, after which both cream and paper letters and numbers are removed from the glass. Monograms may be applied on auto windows or windshield by the same method.

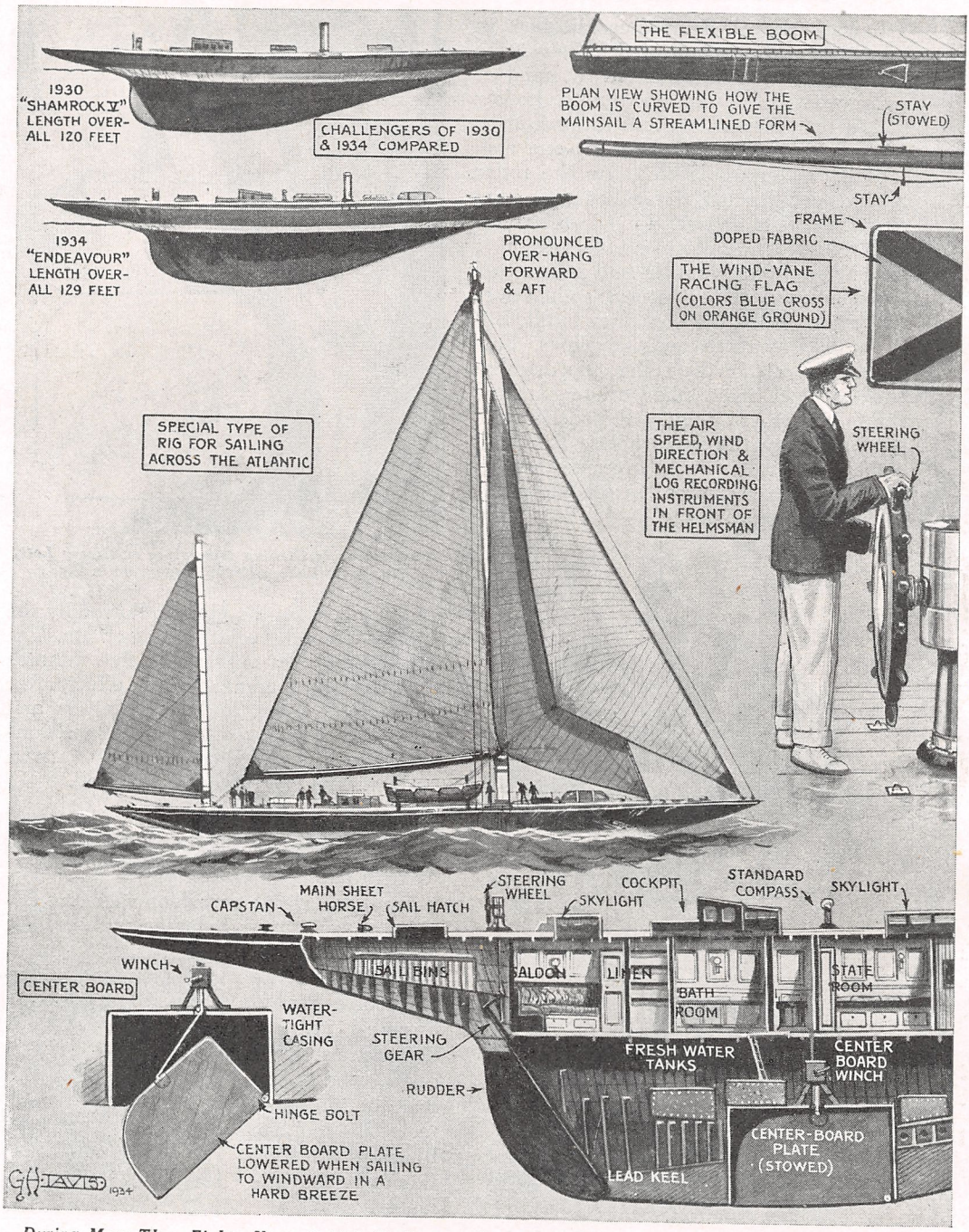
SILENCER SCREWS ON HAMMER TO REDUCE NOISE

Equipped with a screw-on silencing device, an improved hammer makes little noise when in use. The silencer consists of a steel-capped rubber disk that screws on the threaded head of the hammer. The tool can be used with or without the silencer.



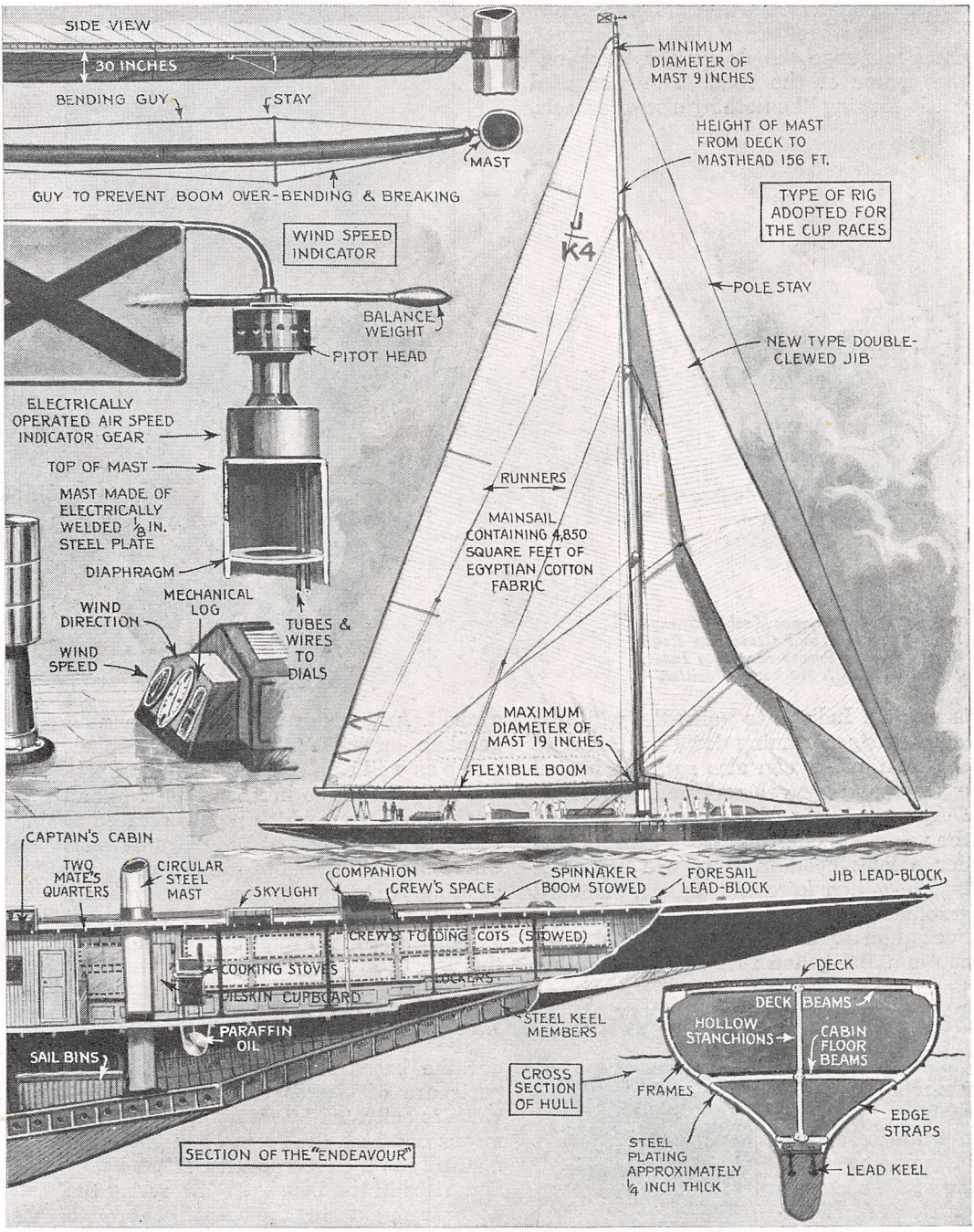
¶A new method of reading fingerprints enables the expert to tell something of the race of the person who made them.

British Cup Challenger Has All-Steel Hull



During More Than Eighty Years British Yachtsmen Have Made Fourteen Unsuccessful Attempts to Wrest the World's Premier Yachting Trophy from This Country; Diagrams Show Details of Construction of the "Endeavour," England's 1934 Challenger; Note the Pronounced Overhang Forward of the All-Steel Hull and the Flexible Boom Which Bends with the Curve of the Mainsail and Sets This Sail into a Streamline Form to Lessen Head Resistance; This Is the First British Challenger to Have an All-Metal Hull and the Construction Cost Was About $150,000

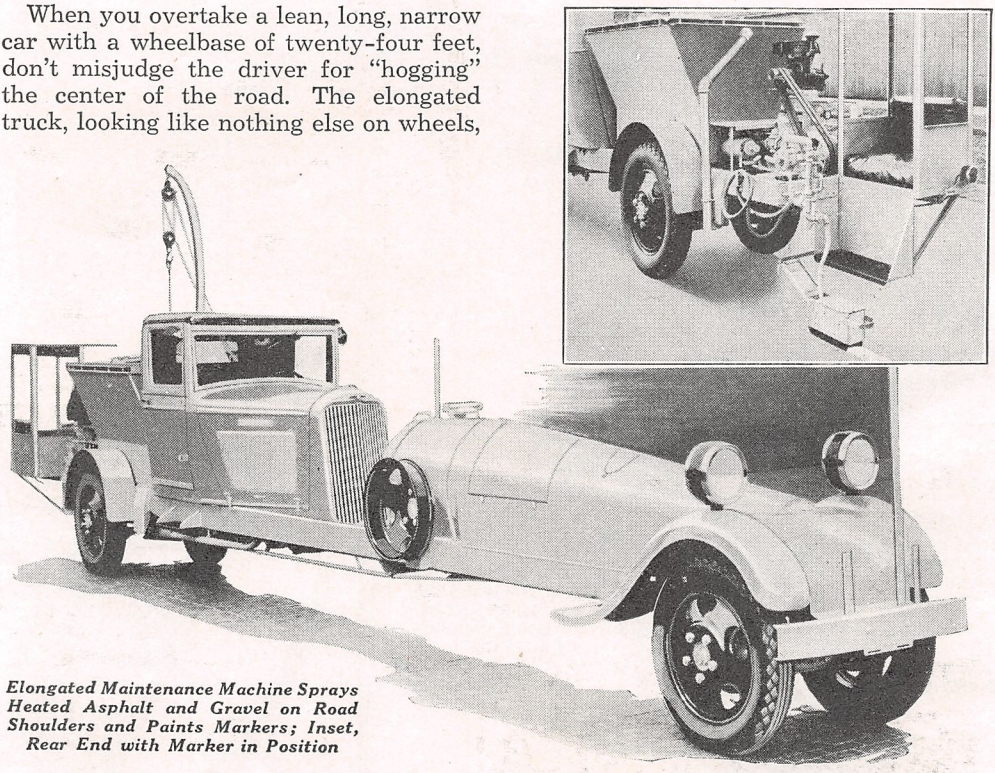
Flexible Boom Sets Sail in Streamline Form



The "Endeavour's" Circular Mast, Weighing More Than 5,500 Pounds, Is Built Up of High-Tensile Steel Plating, One-Eighth Inch Thick and Electrically Welded; the Cutter Has a Racing Flag of Doped Canvas on a Tubular Frame and This Is Mounted on the Masthead on Ball Bearings and Connected with Recording Instruments Giving Wind Direction on a Dial Placed Before the Helmsman; There Is Also a Mechanical Log and a Wind-Speed Indicator Which Operates on Lines Similar to the Air-Speed Indicators with Which Aircraft Are Equipped

Long Wheelbase Truck Paints Road Stripes

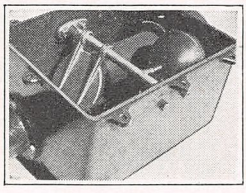
When you overtake a lean, long, narrow car with a wheelbase of twenty-four feet, don't misjudge the driver for "hogging" the center of the road. The elongated truck, looking like nothing else on wheels,



Elongated Maintenance Machine Sprays Heated Asphalt and Gravel on Road Shoulders and Paints Markers; Inset, Rear End with Marker in Position

is used in Indiana to paint the white or yellow stripes running down the center of the road and it can also sprinkle heated asphalt and gravel on road shoulders. Despite the long wheelbase, the tread of the vehicle is only thirty-six inches. Under a long hood in front are housed a twenty-gallon kerosene tank, a standard gasoline tank, a tool box and a seventy-five gallon asphalt tank. Back of the truck cab is a 165-gallon fuel tank for heating asphalt. In the rear of the frame is a small gasoline engine for driving an asphalt pump as well as a compressor for supplying air pressure to kerosene burners and to the tank from which paint is forced to the paint spray box at the extreme rear. There are two masts to aid the driver in steering a straight course. The vehicles are said to steer easily despite their great length. Road marking is speeded up through use of the odd-looking trucks.

Sewer Valve Stops Water from Backing into Basement



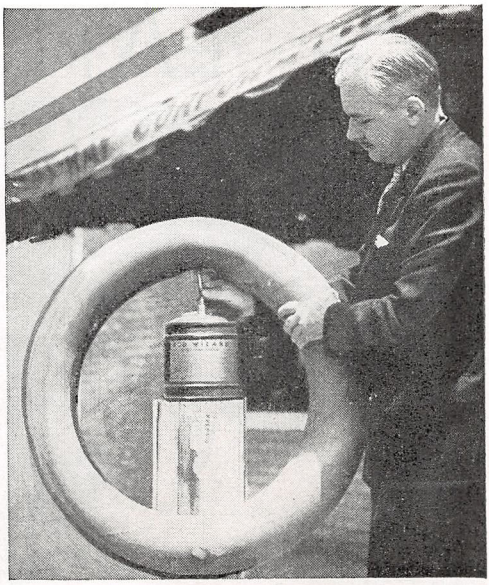
Sewage and flood water are prevented from backing into the basement of the home if the residence is equipped with a sewer valve which is operated by the back-flow. It is contained in a non-corrosive cast-iron box which is attached to the sewer lateral under the basement floor, and all moving parts are of copper or aluminum. The valve is activated by an air-tight float by means of which the gate is brought automatically to a closed position as the back-flow rises in the box, thus preventing the water from entering the basement through the floor drain. The valve also is made in larger sizes for street sewers and sluice, river and tide outlets, as well as between settling basins in disposal plants.

SENSITIVE SWITCH KEEPS HEAT AT EXACT TEMPERATURE

Uniform temperatures, within one-quarter degree of that desired, can be maintained in the home by an unusually sensitive thermostatic switch now on the market. Instead of reacting to temperature changes in the room, the unit is affected by the normal current flow through the instrument. The heat of electricity passing through the switch causes contacts to operate the heating plant. As temperatures drop, the contacts close and start the furnace. At the same time, electricity heats the thermostatic element. When the element has been raised in temperature to the point set on the instrument, the contacts open and stop the furnace. While the element heats faster than the heating plant supplies warmth to the home, it also cools faster, resulting in more frequent operation of the heating plant, but for shorter periods. This causes a steady heat to be produced, holding temperatures at exactly the degree desired and eliminating those

Switch Installed Just above Baseboard; Inset at Top, Closeup of Thermostatic Switch

periods of under and overheating when the plant lags far behind the control system. Mounted near the baseboard, the unit catches the downward drift of room temperature sooner than the occupant.



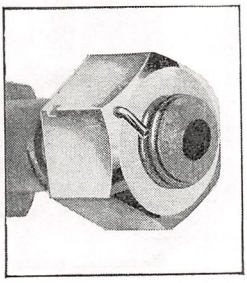
Equipment for Inflating Inner Tube with Reddish Vapor to Reveal Punctures

INNER TUBE LEAKS REVEALED BY RED VAPOR "GUN"

Leaks in inner tubes may be detected easily with a device that sprays a fine vapor into the tube, coating the inner surface. Wherever there is a leak, a moist red spot appears on the outer surface. The device is especially effective on tubes with high-pressure leaks and on porous tubes. It is attached to the regular air line of the service station. Its capacity is one gallon of special fluid.

AUTOMATIC LOCK NUT HAS PIN TO PREVENT LOOSENING

Designed to fit any standard thread, an automatic lock nut has a pin that prevents vibration and shock from loosening the nut. The pin is engaged by the thread of the bolt, following the thread at an angle. The nut can be put on and taken off like an ordinary nut without impairing the thread on the bolt. Nut and pin are manufactured in a single unit.



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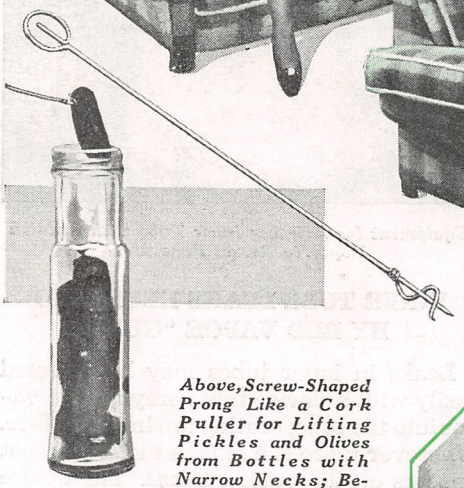

Above, Screw-Shaped Prong Like a Cork Puller for Lifting Pickles and Olives from Bottles with Narrow Necks; Below, Metal Handle with a Suction Cup on the End Which Makes a Sandwich Tray Out of an Ordinary Plate; It Can Be Attached or Removed in an Instant

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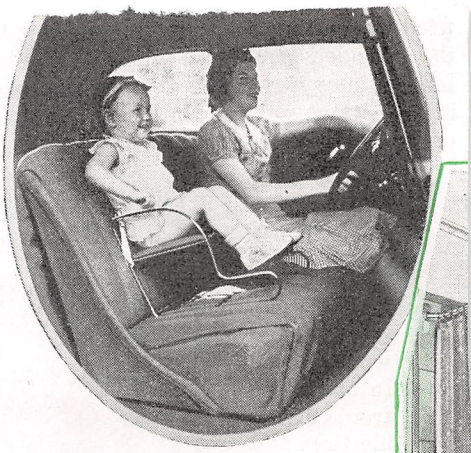
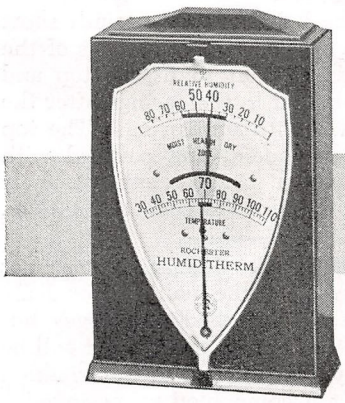
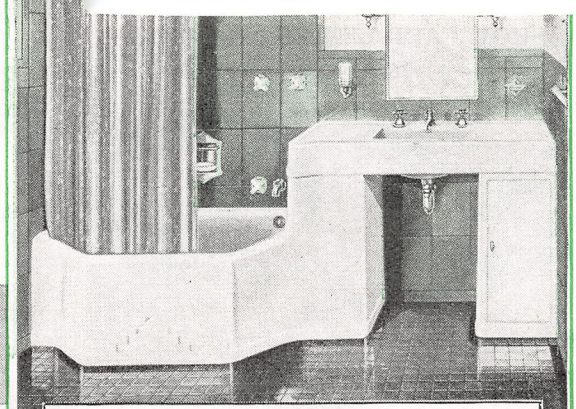


Above, Auto Seat for the Baby Which Is Held in Place with a Safety Strap and Has Comfortable Foot Rest and Arm Supports





Left, Dial Instrument Which Shows Both Temperature and Humidity of Air in Room; Above, Washstand and Bathtub in One Unit; Note Cabinet in Stand and Small Space Occupied

[partial page]

SHOW CARD LETTERING GUIDE MAKES PRINTING EASY

Lettering Guide Outfit Helps Novice Print Attractive Display Cards

Attractive window cards, counter cards and price tickets can be turned out by the novice with the aid of a lettering guide used by pushing down the top and dipping the extended portion into the paint. When the pressure is released, the pen goes back into position and the paint is held in a reservoir and fed automatically.

SPRING SEAT FIRESIDE STOOL MADE FROM OLD TIRES

Comfortable fireside stools large enough to seat two or three people are being made from old automobile tires and coiled springs taken from old seat cushions. Three old casings of the same size are bolted together with short bolts at several points on the sides of the tires. Boards are cut to fit the top and bottom and bolted to the casings after the center is filled with the springs. The top board is then padded and covered with tapestry or other bright cloth which is draped over the sides to conceal the tires.

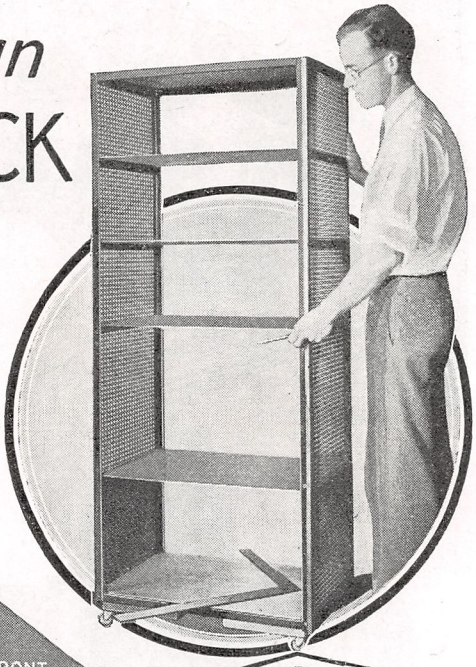
¶Popular Mechanics Magazine does not publish the name of the maker of, or dealer in, any device described in its pages, but this information is kept on file and will be furnished by our Bureau of Information upon request, accompanied by postage.

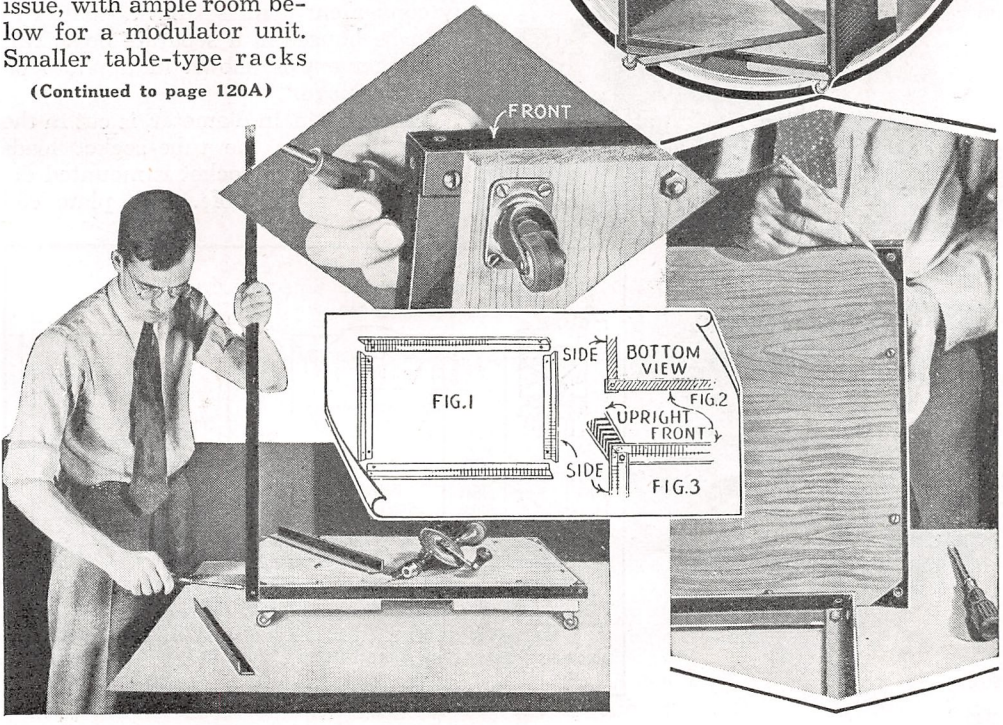
How to Build an AMPLIFIER RACK

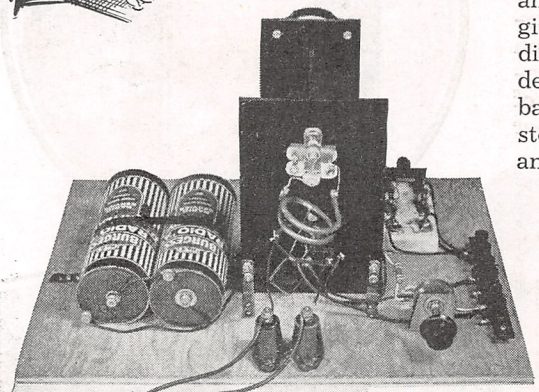
By FRANK L. BRITTIN

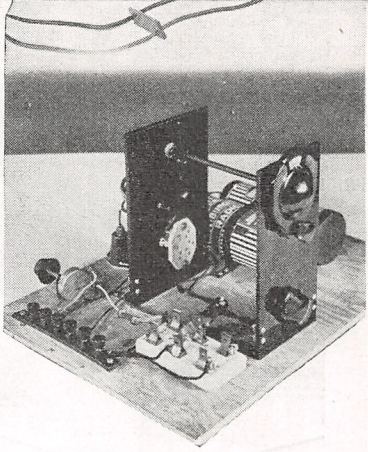
THIS general-purpose rack can be built with few tools and the dimensions may be altered easily to suit individual needs. Construction details are quite simple and the cost is within the reach of average experimenters. The rack shown in the photo may be used to house a complete public-address amplifier including a phonograph turntable. It is also suitable for an amateur transmitter or a speech amplifier of the 3-unit type, described in the October issue, with ample room below for a modulator unit. Smaller table-type racks

(Continued to page 120A)









TWO-WAY

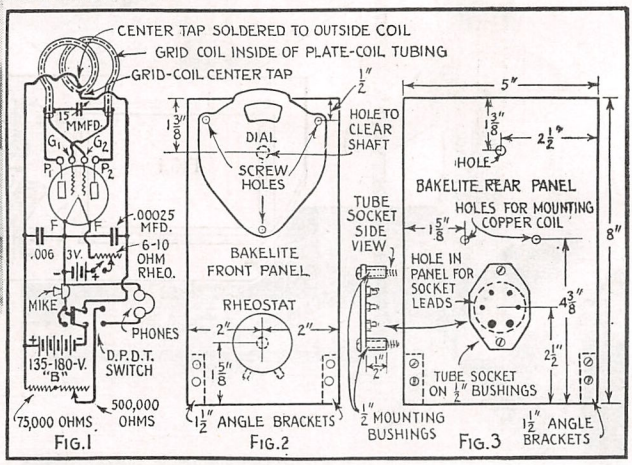
By F. C. JONES and W. F. MARSH

SIMPLICITY is the keynote of this inexpensive one-tube combination phone transmitter and receiver designed for the 5-meter amateur phone band. Although the 5-meter signals, sent and received with this transceiver, are useful over only a few miles, the band is not crowded and there is a thrill in using radio phone even though the other station is only a few houses away.

The type-19 tube employed operates on two ordinary No. 6 dry cells and a bank of either three or four small 45-volt B-batteries.

The plywood base is ⅜ by 12 by 17 in. Two bakelite panels, Figs. 2 and 3, are mounted 6 in. apart, by means of small angle brackets. The schematic diagram is given in Fig. 1 and the simplified wiring diagram is shown in Fig. 4. If the builder desires to make the rig more compact, the baseboard may be smaller and two fahnestock clips, for the dry cells, mounted at any convenient point so that all batteries can be housed in a separate box. This arrangement is shown in a photo on another page.

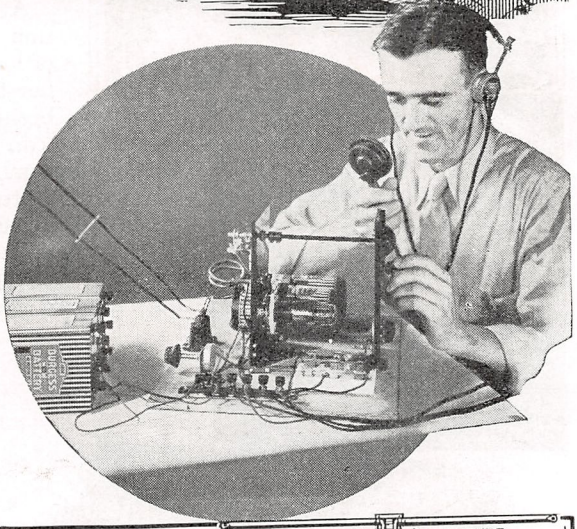
A hole, 1 in. in diameter, is cut in the rear panel for the tube-socket leads and the 6-prong socket is mounted directly over this hole. The plate coil

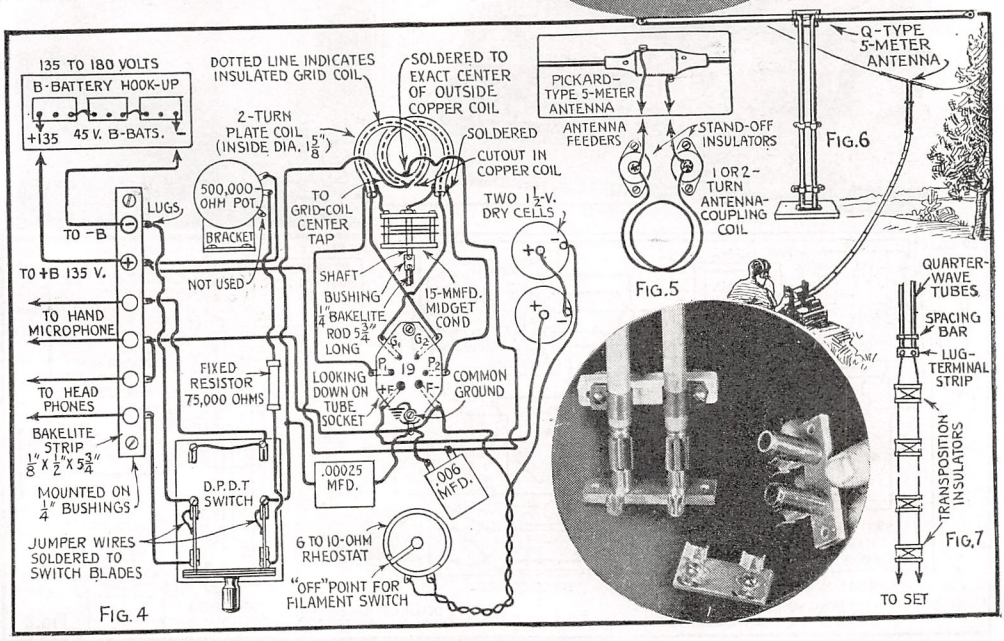


FIVE-METER PHONE for Beginners

consists of two turns of 3/16-in. copper tubing that is easily wound on a form 1⅝ in. in diameter. A hole is cut in the exact center of this copper coil with a file, so that the flexible insulated wire for the grid coil, inserted inside, may be brought out for its center tap. Tape the soldered center-tap grid-coil connection carefully so that it will not short on the copper coil. The ends of the copper coil fit tightly in the holes drilled in the rear panel and extend through the panel. The variable condenser

(Continued to page 124A)





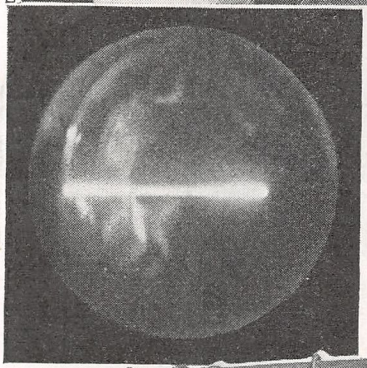
Low-Cost Power Unit for Cathode-Ray Tube

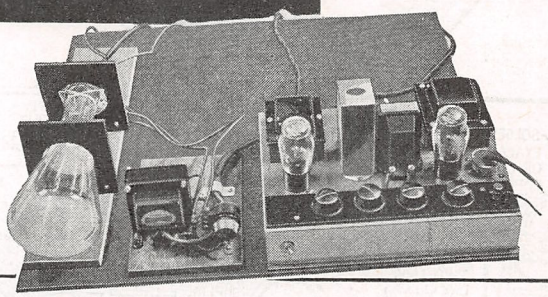
By EDWIN EWING

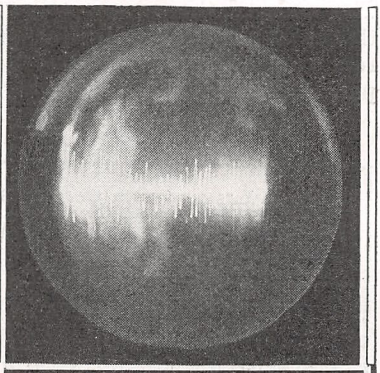
NOW that reasonably priced cathode-ray tubes are available, an entirely new field has been opened for the amateur experimenter. Service men also are provided with the means for constructing a useful oscilloscope previously found only in large laboratories. The purpose of this article is to describe an inexpensive power unit suitable for most of these tubes.

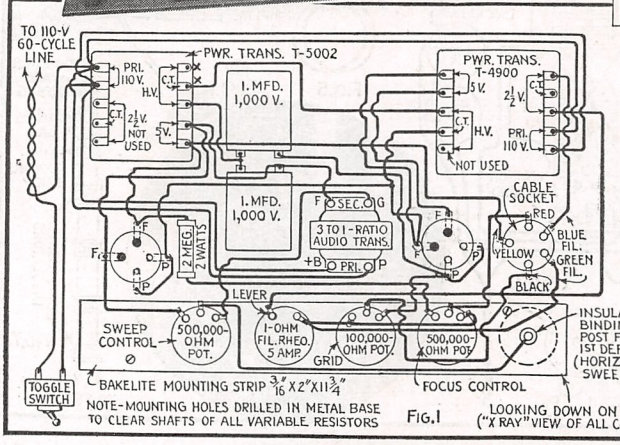
A voltage-doubling system of rectification is employed, which permits the use of low-voltage filter condensers and rectifier tubes. The transformers are ordinary broadcast types and all parts, with a few exceptions, can be salvaged from old receivers. The wiring diagram is given in Fig. 1. The cable, tube and vertical-amplitude transformer are shown in Fig. 2. As the tube-socket connections given are for an experimental cathode-ray tube, they will vary slightly for the RCA type-906, and Dumont tubes, which do not have external-clip connections on the base.

(Continued to page 122A)

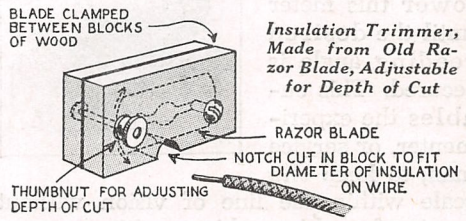




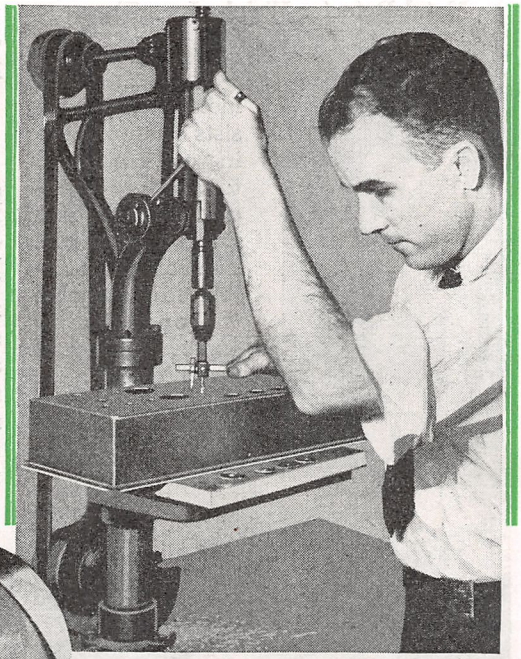




Practical RADIO *SUGGESTIONS*

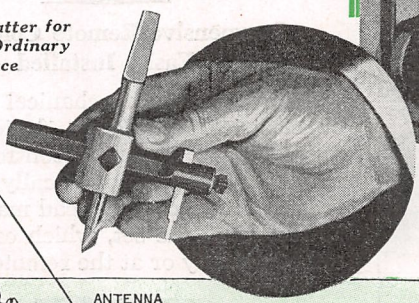


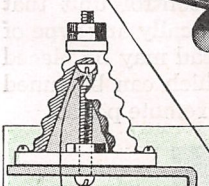
Insulation Trimmer, Made from Old Razor Blade, Adjustable for Depth of Cut

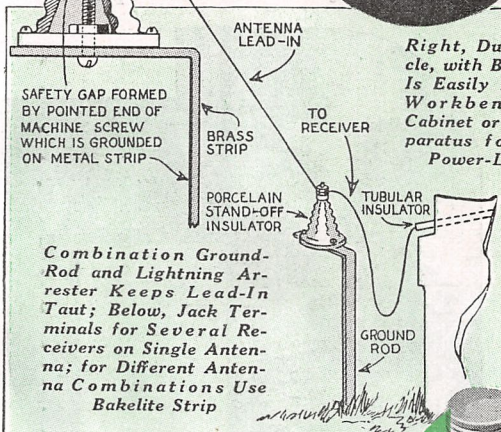


Above, Cutting Large Holes for Mounting Tube Sockets and Other Parts on Metal Bases; Adjustable Fly Cutter Has Round Shank That Fits Hand or Power Drills

Right, Fly Cutter for Use in an Ordinary Bit Brace

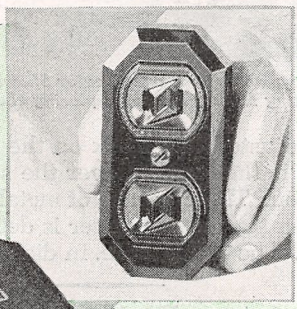


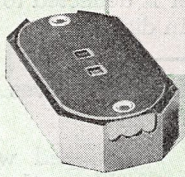


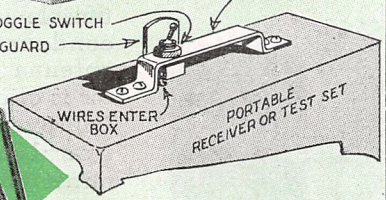


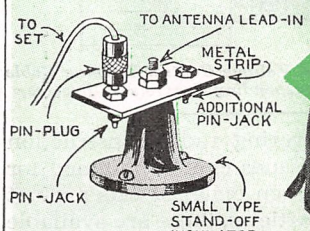
Combination Ground-Rod and Lightning Arrester Keeps Lead-In Taut; Below, Jack Terminals for Several Receivers on Single Antenna; for Different Antenna Combinations Use Bakelite Strip

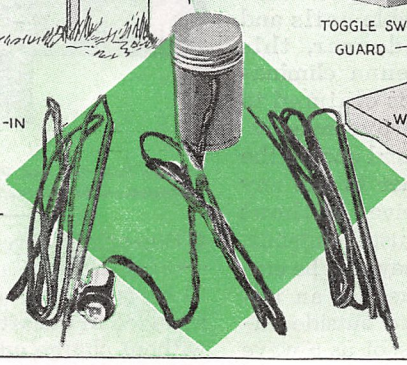
Right, Duplex Receptacle, with Bakelite Cover, Is Easily Mounted on Workbench, Receiver Cabinet or Amateur Apparatus for Convenient Power-Line Outlets







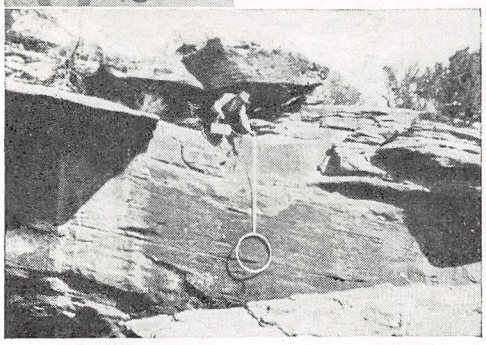




Above, External Switch for Portable Apparatus; Left, Handy Continuity Tester Has Flash Lamp Mounted on Test Prod; Small Battery Fits in the Pocket

Metal Detector Weighs Less Than Ten Pounds

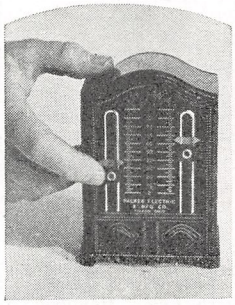
This compact metal locator consists of an exploring coil connected to a battery-operated unit with a length of cable. The coil and flexible cable enable the operator to explore the face of a cliff, or old mine shafts, without leaving the top level. The meter



Above, Portable Metal Locator Showing Coil and Indicating Meter; Below, Exploring the Face of a Cliff

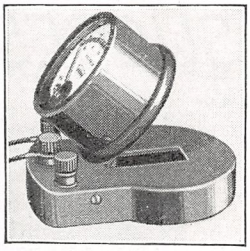
is adjusted to a mark on the dial and the coil is then moved over the suspected location. The presence of metal is indicated when the meter pointer is deflected to the left. The coil is 28 in. in diameter

Antenna Eliminator Also Serves as Wave Trap



Equipped with tunable coils and condenser, this antenna eliminator is claimed to improve selectivity and enable the owner to use any receiver without the usual antenna. It may also be employed as an adjuster to regulate a standard outside antenna for all-wave receivers, or as a wave trap, to tune out interfering stations. The connections to the receiver are quite simple and can be made by any set owner.

Portable Meter Has Hinged Mounting



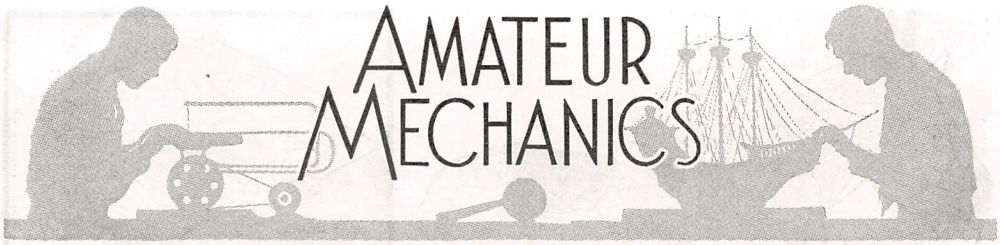
A sturdy hinging arrangement is used to raise or lower this meter until the desired reading angle is secured. This enables the experimenter, or service man, to keep the scale within the line of vision without moving from his working position.

Inexpensive Remote Control Is Easily Installed

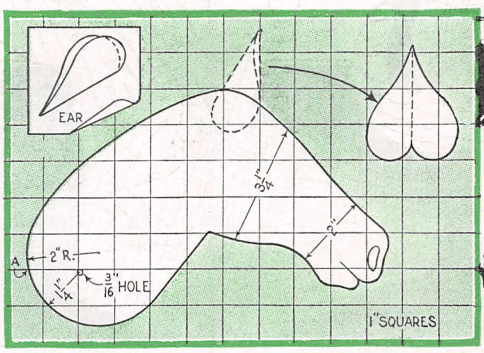
No complicated mechanical connections or electrical contacting devices are required for this remote-control unit that may be attached to practically any type of receiver. The control head may be placed 15 feet from the set, which can be tuned either directly or at the remote point.

Station Selector and Volume Control Showing Cable Connected to Corresponding Controls on Receiver

¶Blueprints covering radio construction articles in past issues can be obtained for 25 cents each; when material lists are not included in the articles, these are available without charge on receipt of postage.

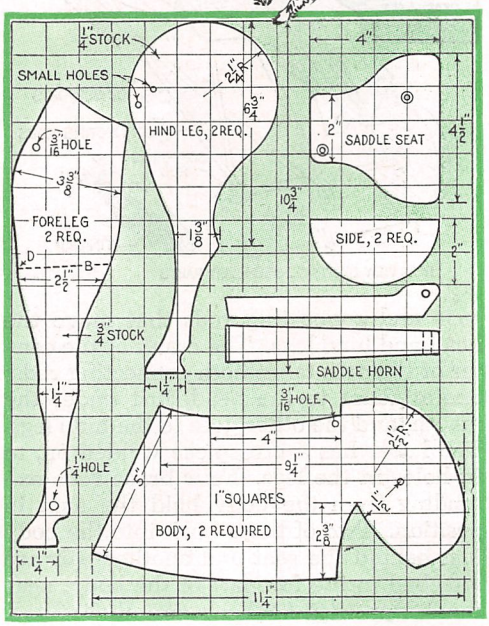


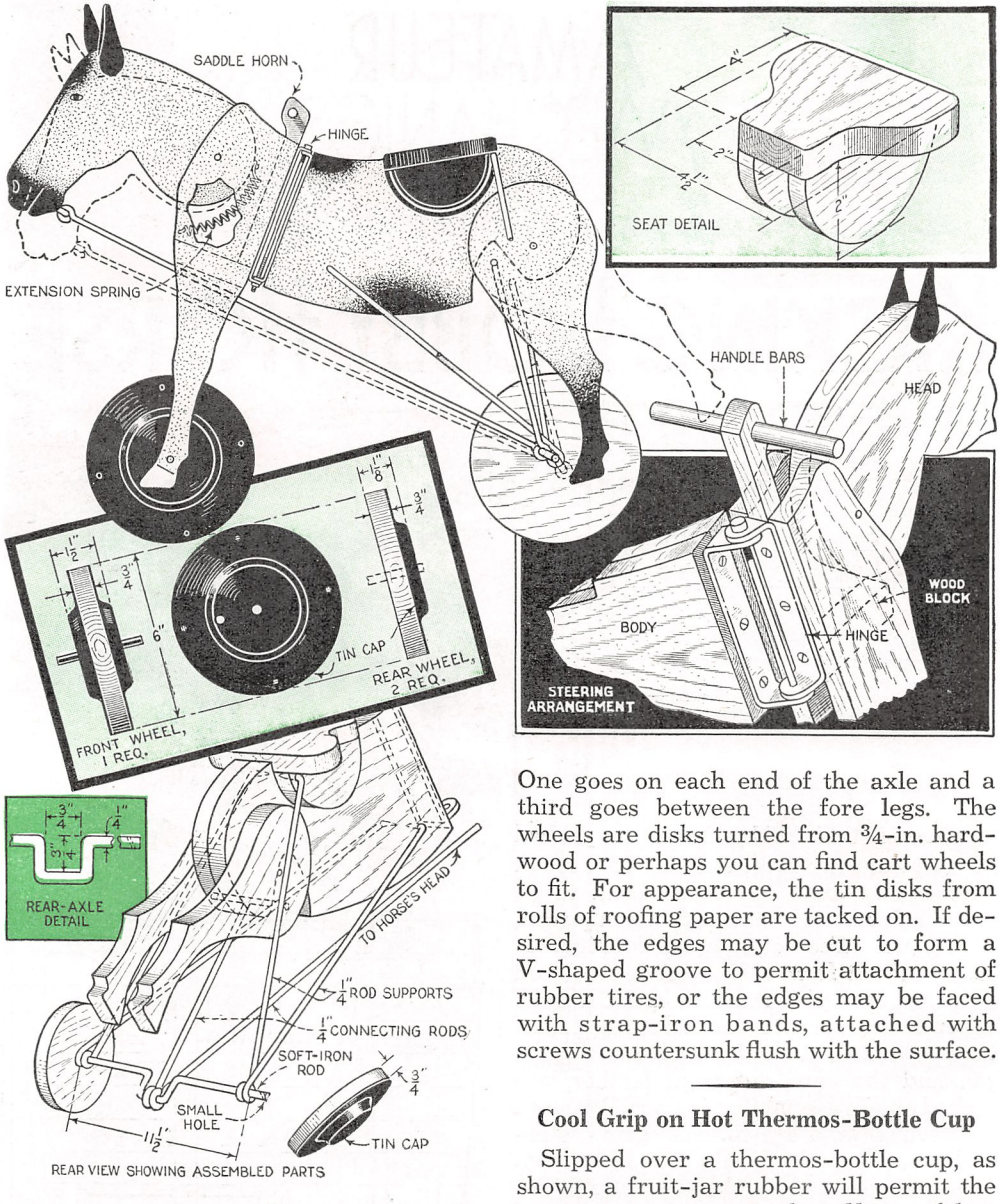
KICKING HOBBY HORSE



By A. A. STEVENS

WHEN this hobby horse is pushed along, two rods, working on a crank in the rear axle, cause the head to be moved down and the hind legs upward, giving the effect of a horse kicking. It may be built from a few pieces of ¾ and ¼-in. lumber, and the rods and tin disks taken from several rolls of roofing paper. A hole is drilled in the neck for a pivot pin and the ears, cut from leather, are tacked on. In assembling the head between the front legs, a 4½-in. coil spring is attached to keep the head erect. The front legs are separated by blocks a trifle thicker than the head, allowing it freedom of movement. The upper block projects above the top of the legs and is fitted with a piece of dowel rod to form handle bars. A flat-iron hinge, parts of which are joined by a pin, connects the front leg and head assembly to the body, permitting the horse to be turned in either direction. The rear legs are pivoted to the body, one on each side, using a suitable bolt with washers between legs and body. Iron rods, ¼ in. in diameter, are used for the axle, bracing



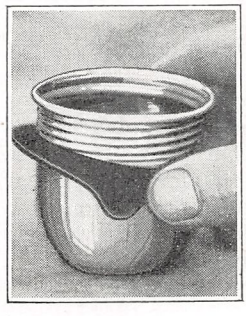


REAR VIEW SHOWING ASSEMBLED PARTS

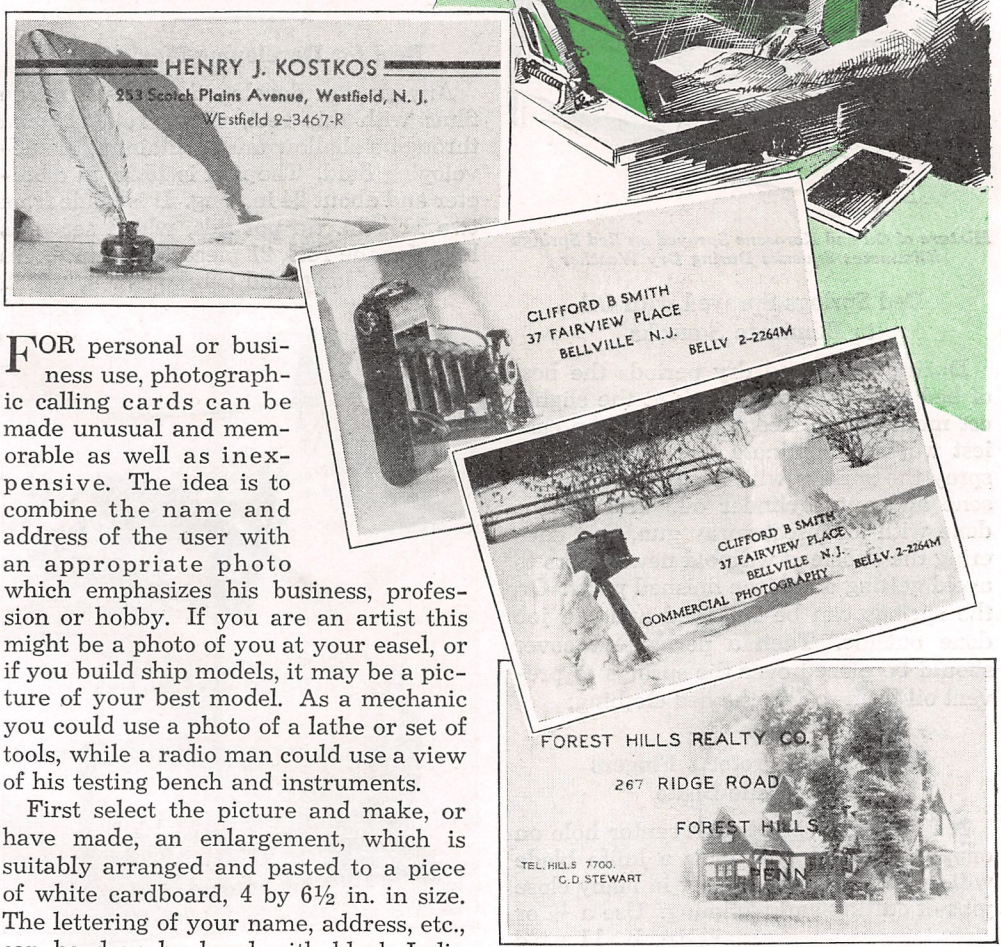
rods and connecting rods that move the head and hind legs. The crank at the center of the axle takes both connecting rods; one attaches to the head, just under the mouth, and the other goes to the hind legs. The latter has a crosspiece welded on, to fit holes in the legs. Four brace rods extending from the body hold the axle in position. Two of these hook into the body just behind the seat and another pair are attached to the forepart of the body, near the lower edge. Wheels are then fitted. One goes on each end of the axle and a third goes between the fore legs. The wheels are disks turned from ¾-in. hardwood or perhaps you can find cart wheels to fit. For appearance, the tin disks from rolls of roofing paper are tacked on. If desired, the edges may be cut to form a V-shaped groove to permit attachment of rubber tires, or the edges may be faced with strap-iron bands, attached with screws countersunk flush with the surface.

Cool Grip on Hot Thermos-Bottle Cup

Slipped over a thermos-bottle cup, as shown, a fruit-jar rubber will permit the handling of hot coffee with less danger of burning your fingers. The ears of the rubber form contacts for the finger ends, keeping them from direct contact with the hot cup. The rubber is easily kept clean.

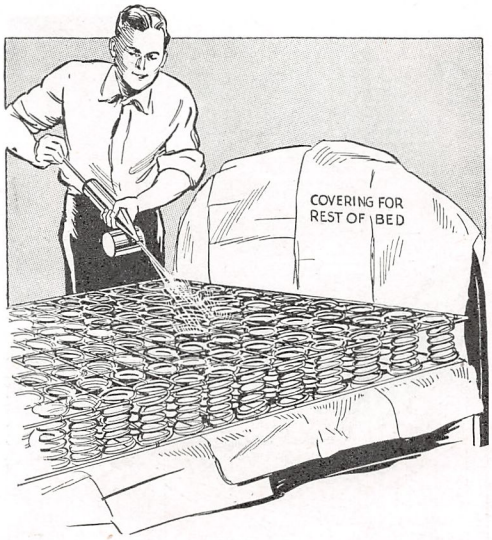


Photographic CALLING CARDS . .



FOR personal or business use, photographic calling cards can be made unusual and memorable as well as inexpensive. The idea is to combine the name and address of the user with an appropriate photo which emphasizes his business, profession or hobby. If you are an artist this might be a photo of you at your easel, or if you build ship models, it may be a picture of your best model. As a mechanic you could use a photo of a lathe or set of tools, while a radio man could use a view of his testing bench and instruments.

First select the picture and make, or have made, an enlargement, which is suitably arranged and pasted to a piece of white cardboard, 4 by 6½ in. in size. The lettering of your name, address, etc., can be done by hand with black India ink. In some cases this matter can be set up by a printer and the proof pasted on the card. Be sure to have the lettering twice the size that it is to be on the calling card. After the enlarged card has been completed, it is photographed. On a camera that has a ground glass, mark a 2 by 3¼ in. rectangle on it with a pencil. Adjust the focus and distance from the card until its image just fills the rectangle, and the details show up sharply. This method can also be used on a roll-film camera, by fitting a sheet of tracing paper across the film guides. This will then serve the purpose of a ground glass. Then make the exposure in the usual way. The resulting negative can be used indefinitely and a fine linen-finished paper is appropriate.



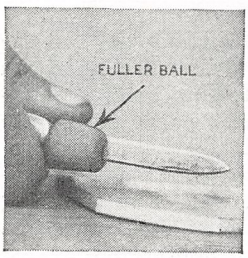
Mixture of Oil and Kerosene Sprayed on Bed Springs Eliminates Squeaks During Dry Weather

Bed Springs Sprayed with Oil to Eliminate Squeaks

During continued dry periods the best of bed springs often squeak at the slightest move of the sleeper. One of the easiest ways to eliminate the squeaks is to spray the springs with a mixture of kerosene and auto cylinder oil. This can be done with an insect spray gun, first covering the bedstead with old newspapers to avoid getting oil on the finished parts. Or, the springs can be removed and the job done outside. Then a permanent cover should be placed over the springs to prevent oil from soiling the bed clothing.

Fuller Ball Protects Fingers from Knife Blade

A fuller ball split to the center hole on one side and slipped over a knife blade will protect the index finger in many close jobs of cutting and trimming. Use a ½ or ⅜-in. ball and place it in the position shown in the photo. The ball fits snugly and will make a great deal of difference in the ease with which the knife can be manipulated.

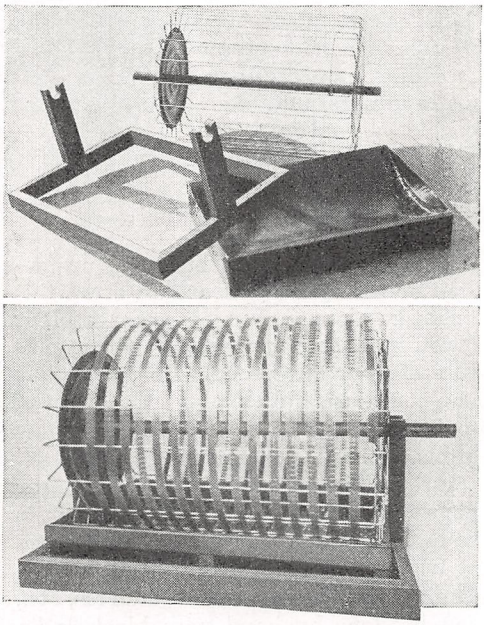


How to Prepare Ground Glass for Fine Focusing

When it is necessary to make extremely sharp pictures with a camera, make a spot about the size of a quarter of a dollar on the matte side of the ground glass with glycerine. Focusing is done at this spot, preferably with a magnifying glass. This method is especially desirable when focusing near-by objects and the depth of focus is small.

Reel for Developing Movie Film

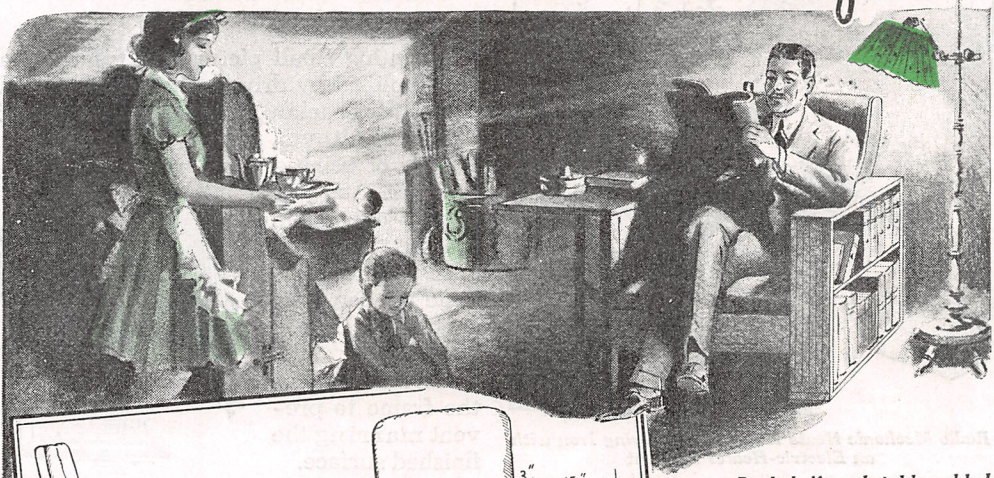
Anyone can develop their home movie films with this reel, which rotates them through a shallow tank containing the developing fluid. The reel is 15 in. in diameter and about 24 in. long. It is made from two 11½-in. tin pot lids, which serve as hubs for the reel, 21 pieces of ⅛-in. brass rod, 25 in. long, and a broomstick, which serves as an axle. The rods are bent at right angles 2 in. from each end and are soldered to the lids as indicated. A developing tank to fit the reel is made of sheet tin nailed to three wood blocks and a frame supports the reel which will accommodate 100 ft. of film if spacers are used.

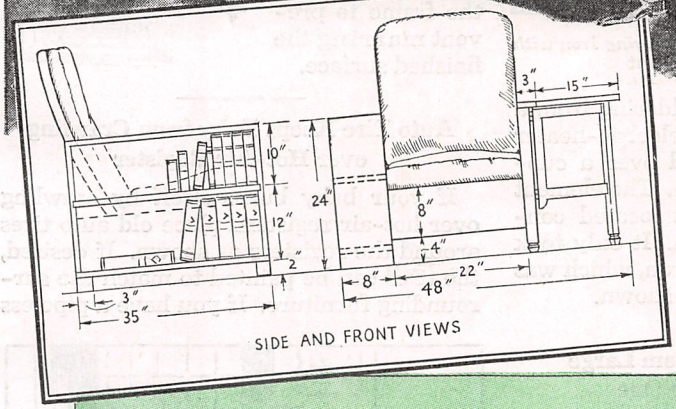


Reel Made of Tin Lids and Brass Rods Rotates Movie Film in Developing Fluid

Novel ENGLISH CHAIR

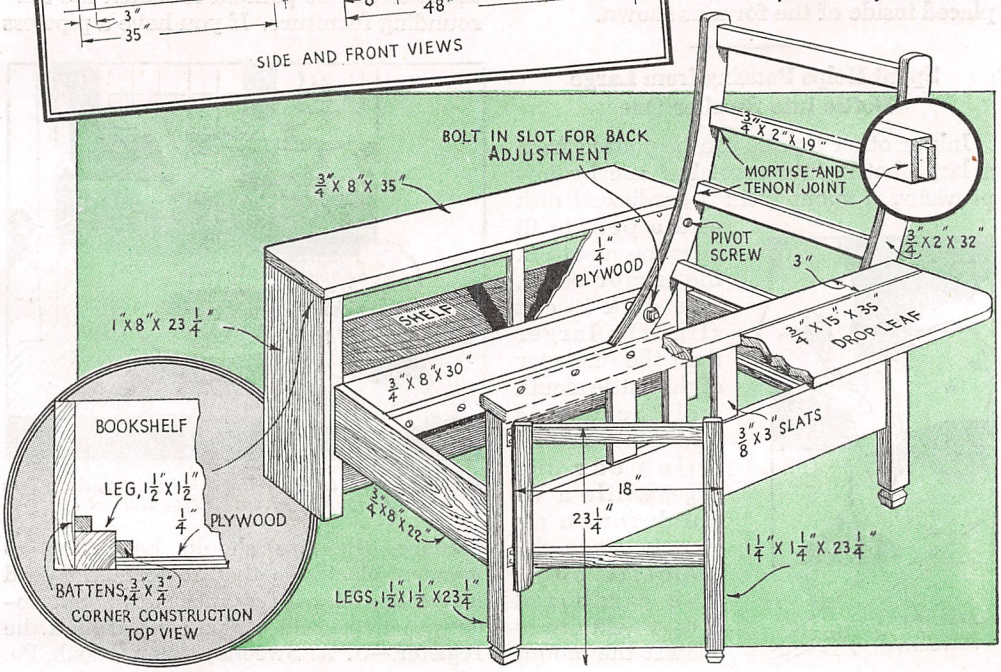
combines table and bookshelf





SIDE AND FRONT VIEWS

Bookshelf and table added to this easy chair make it ideal for home comfort. A gate leg, hinged to the front leg, swings back against the chair arm when the table leaf is dropped. The curved chair is pivoted near the top of the rear legs and a bolt in a slot, at the other end, permits adjustment



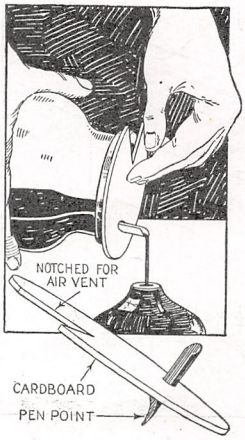
Utilizing Electric-Heater Element to Heat Soldering Iron

Radio Mechanic Heats His Small Soldering Iron with an Electric-Heater Element

Not having an electric soldering iron, a radio mechanic used an electric-heater element of the type wound over a cup-shaped form, to heat his iron. The element was screwed into a socket located conveniently on his workbench. It only took a few moments to heat the iron, which was placed inside of the form as shown.

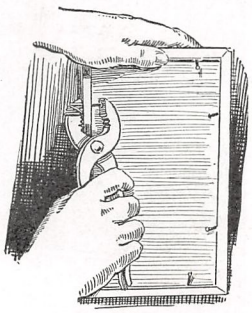
Spout Helps Pouring from Large Bottle into Smaller One

Ink or other liquids can be poured from a large bottle into a smaller one by improvising a spout from a cardboard disk and a pen, to fit over the mouth of the larger bottle. The disk is cut slightly larger than the diameter of the bottle mouth and the pen is forced into a small hole near one edge, while a V-notch for an air vent is cut in the opposite edge. The cardboard disk is held firmly against the mouth of the larger bottle while the fluid is being poured. This method proved more efficient than using a paper cone when a funnel was not at hand.



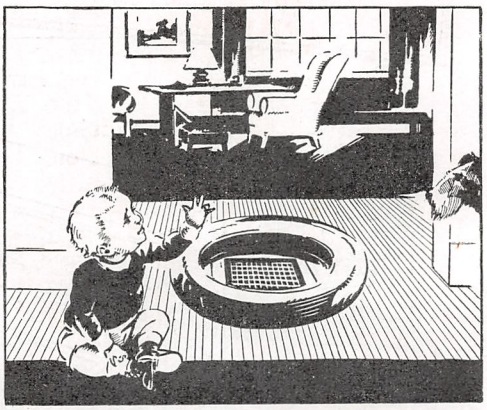
Brads Driven in Picture Frame with a Pair of Pliers

Mounting small pictures in frames can be simplified by driving the brads to hold the picture backing in place with a pair of pliers as shown, instead of using a hammer. Any pair of slip-joint pliers are suitable for this purpose. A wide rubber band should be slipped over the jaw of the pliers that contacts the frame to prevent marring the finished surface.



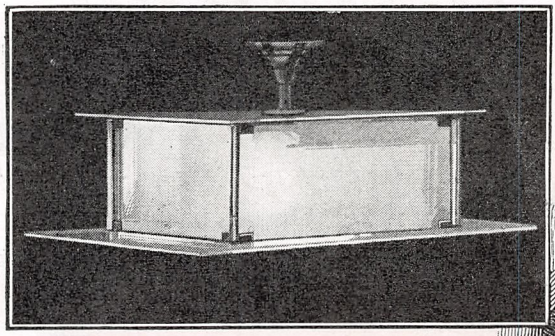
Auto Tire Keeps Baby from Crawling over Hot-Air Register

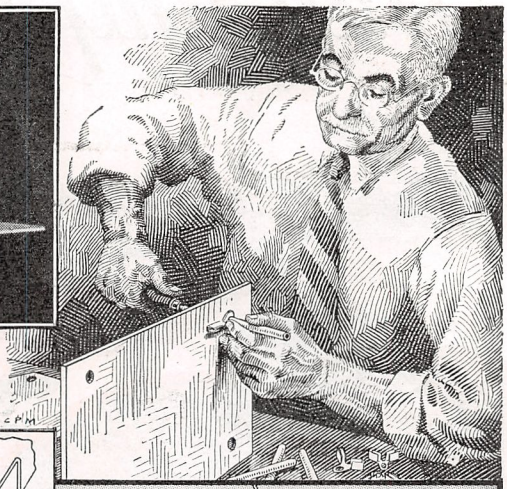
If your baby burns itself by crawling over hot-air registers, place old auto tires around the registers as shown. If desired, the tires can be painted to match the surrounding furniture. If you have a pipeless furnace, the tire should be nailed to wooden blocks so that it will be raised above the floor a few inches to avoid obstructing the cold-air passage around the register.—J. W. Sweeney, Shenandoah, Pa.

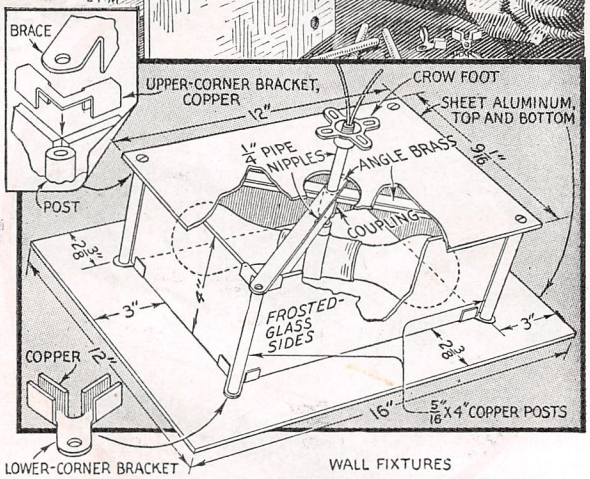


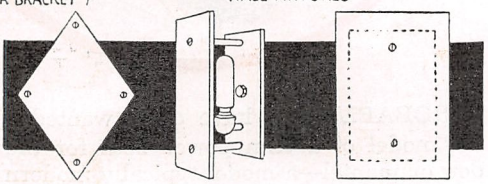
Painted and Placed over Hot-Air Register, Auto Tire Keeps Baby from Getting Burned

Wall and Ceiling Fixtures in Modern Style







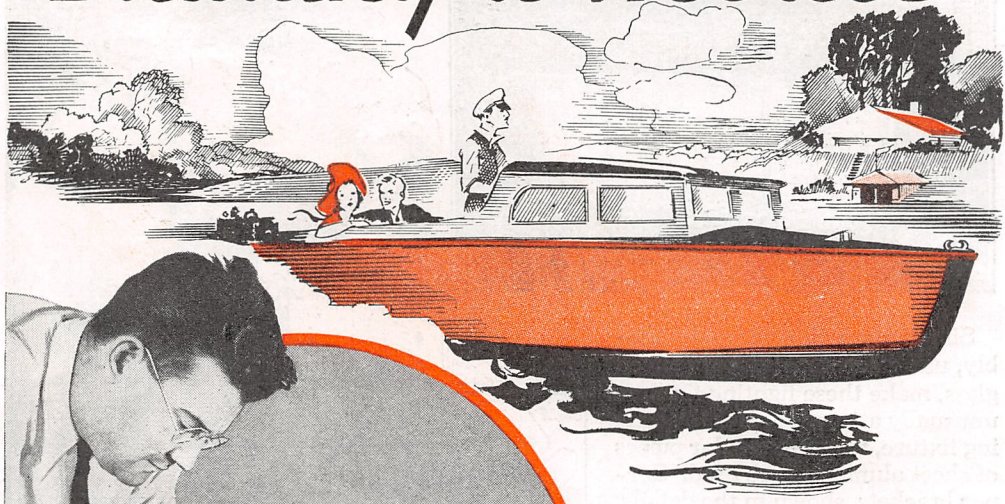


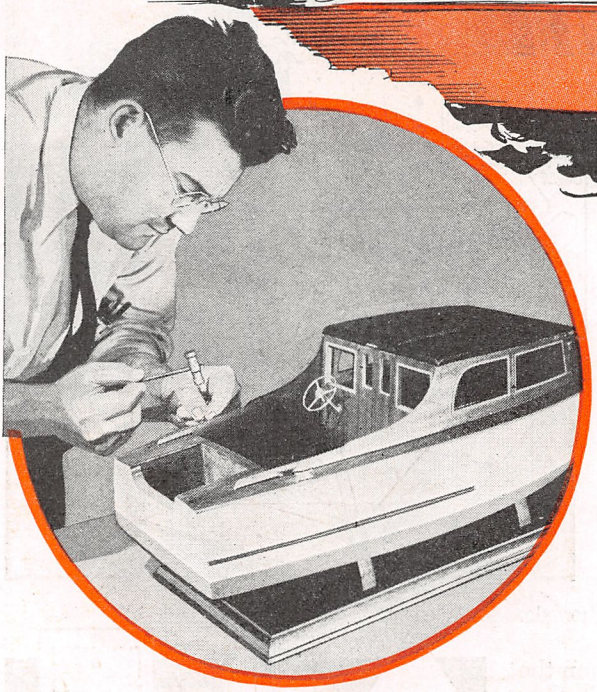
Simplicity of design and assembly, using sheet metal and frosted glass, make these lighting fixtures unusually attractive. For the ceiling fixture, two rectangular pieces of sheet aluminum are used. Corner brackets, shown in the details, are formed to hold the frosted-glass sides. Copper or aluminum posts are drilled and tapped at each end, so that when screws are driven through the top and bottom pieces, into the ends of the posts, after they have been set on the corner brackets, the whole assembly is held together securely. Crosspieces under the top are drilled to take a pipe nipple which is screwed into a double socket and a "crowfoot." Thread the pipe on the outside so that two locking nuts can be used to hold it securely on the crosspieces. A length of aluminum tubing and a canopy to match are then slipped on, the crowfoot being removed temporarily and screwed to the ceiling. After wiring, the fixture is attached to the crowfoot and the canopy slipped up to hide it. The lower details give suggestions for wall fixtures which will go well with the ceiling unit.—C. J. Colwell, Chicago.

Checking Spring Tension on Breaker Arm of Distributor Points

Unsatisfactory operation of an auto motor is sometimes caused by incorrect tension of the spring on the breaker arm of the points in the distributor. This spring should be strong enough to cause good contact between the points at all motor speeds. The tension ranges between 18 and 22 oz. as measured by a spring scale. An ordinary spring balance in a horizontal position may be used for checking the tension while the timer is in place on the car. If greater accuracy is necessary, it is best to remove the distributor and hold it in the hand so that the spring balance will work in a vertical position, thus making the correct allowance for the weight of the scale hook. Too much tension will shorten the life of the points.

Building a Model



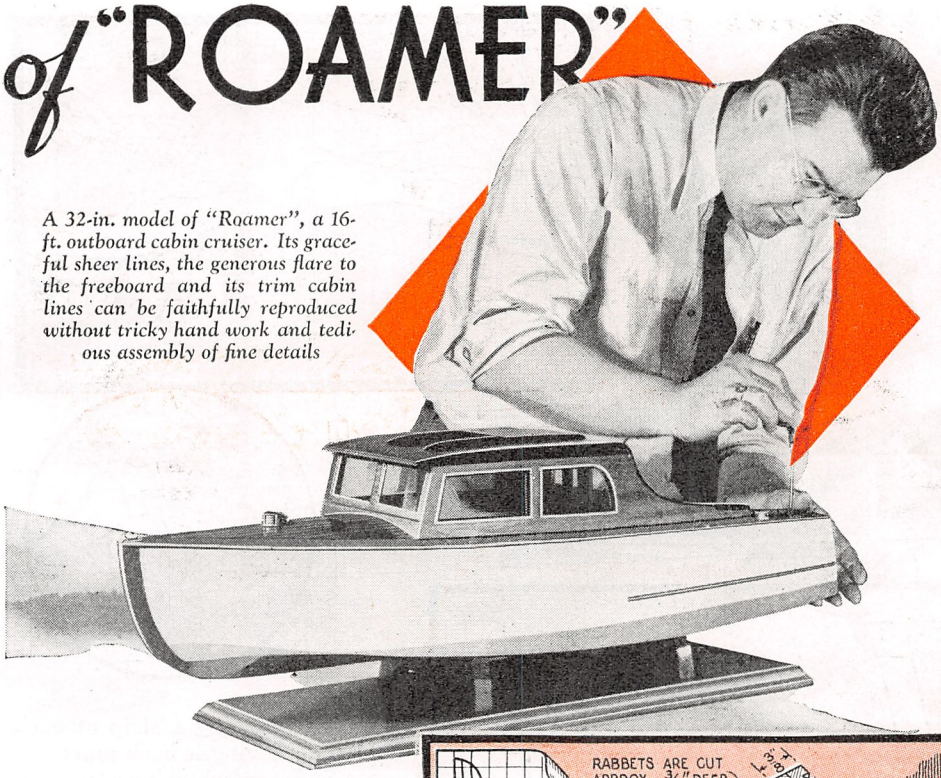


PROBABLY you have often wanted a model of a trim power boat for the den or mantel—a model typically modern and one that you have built yourself. Very few designs lend themselves so admirably to this purpose as that of "Roamer," and a miniature of this 16-ft. outboard cabin cruiser will catch the eye of any boat enthusiast. A scale of 2 in. per foot was found advisable, which gives the model an over-all length of 32 in. and a beam amidships of 11 in. This size enables you to make use of ready-made fittings offered by dealers in model supplies, although, if you wish, you can make them yourself.

Construction of the model begins with the stem detailed in Fig. 1. This is built up of two pieces of 3/16-in. birch plywood cut roughly to form and glued together with casein glue. When dry, the part is sawed and sanded to the finish size and rabbeted as shown in the sectional view. Next, the white-pine keel and the hardwood keel form are made as shown in Fig. 2. One end of the keel is beveled to fit the notch in the stem. It is also rabbeted the entire length as shown in the cross section. The keel form is hollowed on the top edge to a depth of 1/4 in. at the center of the curved portion, the dimensions indicating the approximate length of the curved section. The stem is fastened to the keel with screws and glue, the keel form is fitted with an upright and crosspiece as shown in Fig. 2, and the keel and stem are fastened to the form with screws. This arrangement holds the parts securely in place while assembling the hull.

The next step is to saw out the eight frames detailed in Fig. 3. Sketch each half frame from a center line on heavy wrapping paper, then fold the paper along the center line with the pattern on the outside after which you can cut along the line with a pair of scissors, making both sides symmetrical. The pattern is then pasted lightly on 3/8-in. white-pine plywood, as a

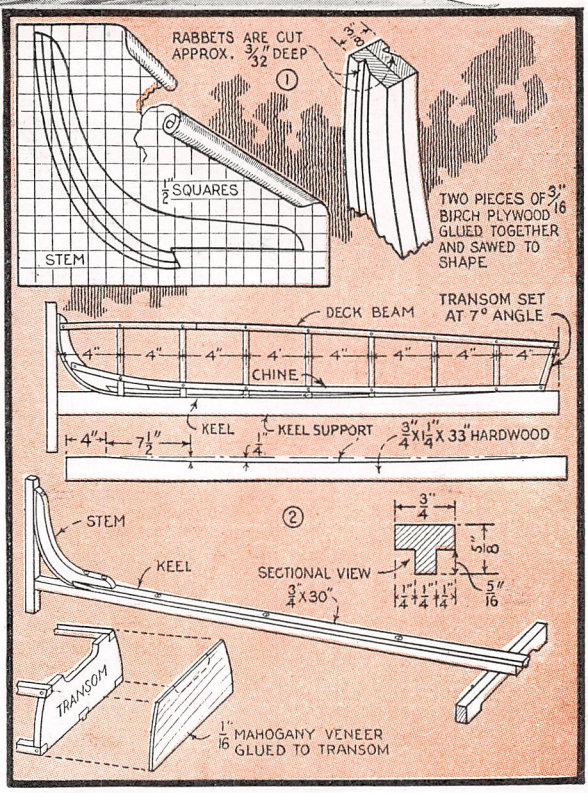
of "ROAMER"

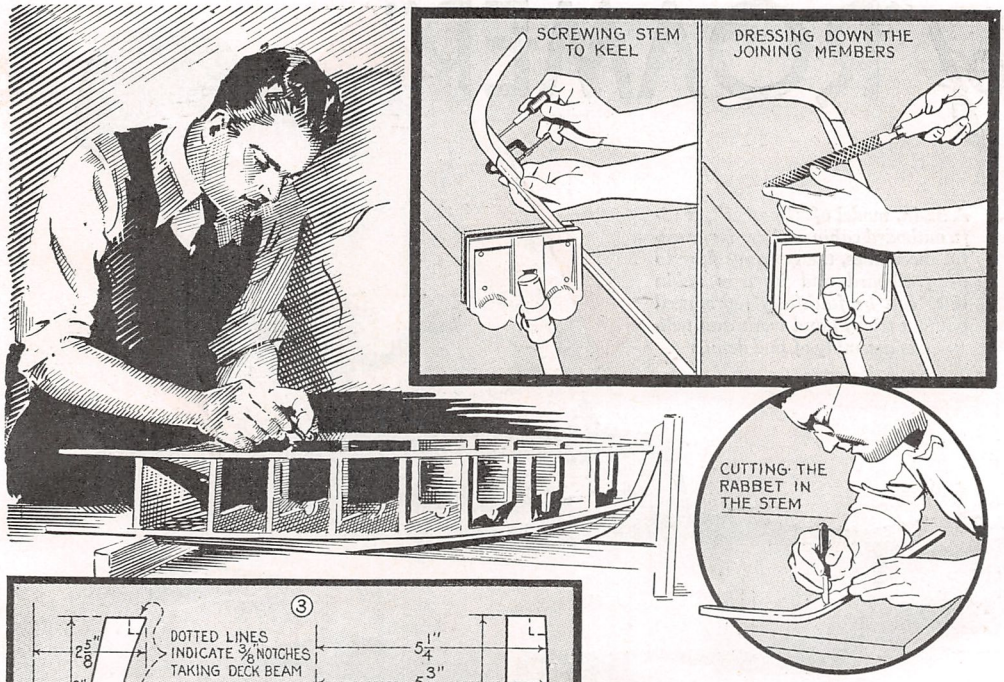


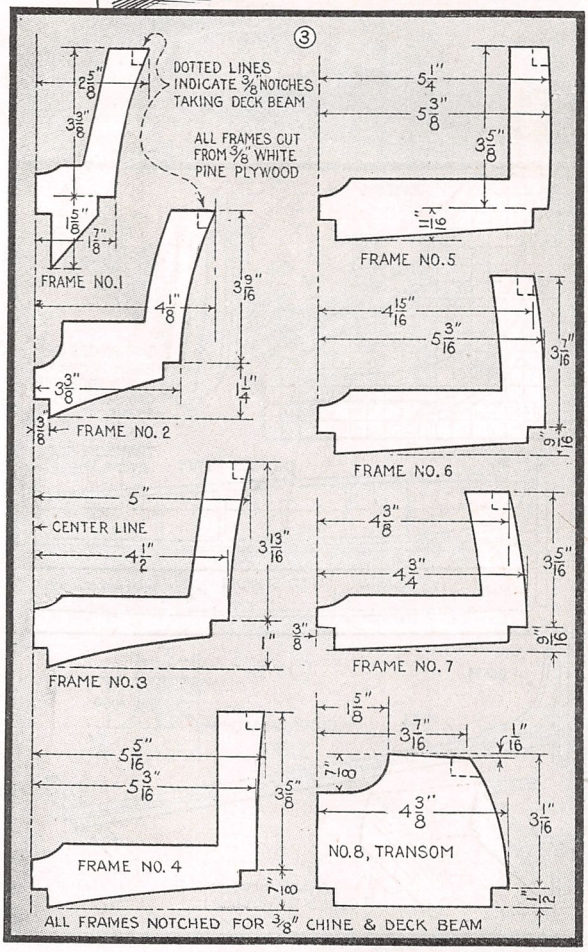
A 32-in. model of "Roamer", a 16-ft. outboard cabin cruiser. Its graceful sheer lines, the generous flare to the freeboard and its trim cabin lines can be faithfully reproduced without tricky hand work and tedious assembly of fine details

guide for cutting to size with the scroll saw. The notches for the deck beams are indicated by dotted lines; they must be cut as shown so that the lower edge of the beam will overhang on the forward frames and the upper edge on the after frames. Note from Fig. 2 that the frames are spaced 4 in. apart on the keel and that the transom, which is frame No. 8, is set at an angle of approximately 7° with the keel. In fitting frame No. 1 it will be necessary to taper the end of the keel on both sides where it joins the stem so that the frame will fit down over the end of the keel. Join the seven frames to the keel with glue and No. 4 flat-head brass screws, ⅝ in. long, leaving the transom loose until the chines and deck beams are screwed and glued in place.

Both chines and deck beams are ripped ⅜ in. square from clear white pine, 36 in. long. Bending is

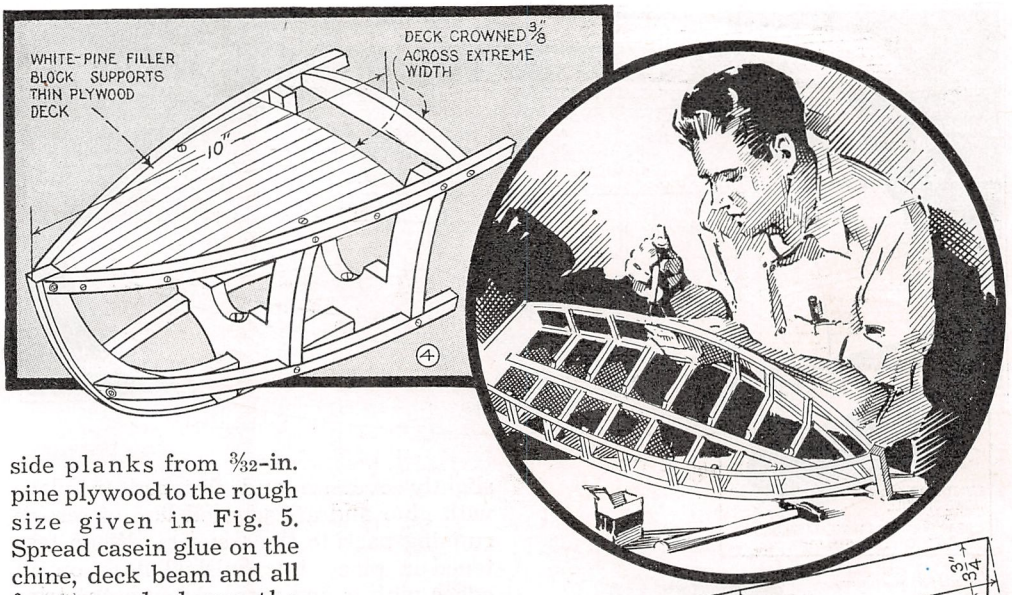




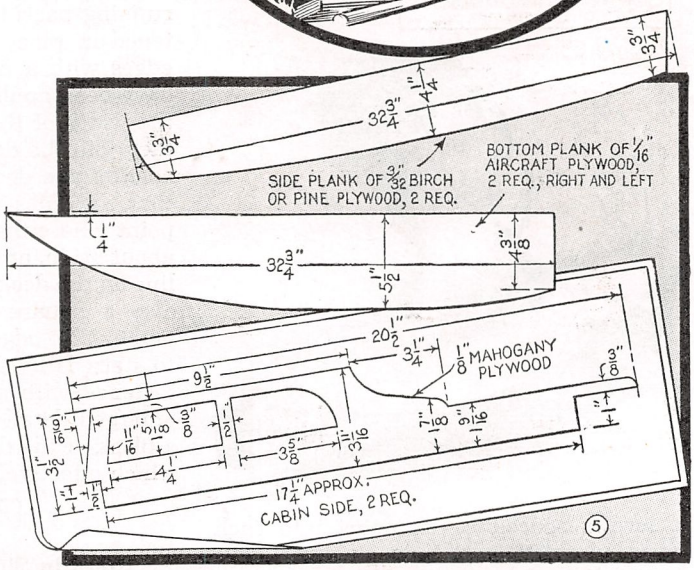


done by grasping a strip at each end, and moving it back and forth over a flame while applying a bending pressure with the hands. Fit and join the chines first, using casein glue and No. 4 flat-head brass screws ⅝ in. long on each frame. The heads of the screws must be countersunk below the surface to allow for fairing up in preparation for the side and bottom planking. Cut off the projecting ends of the chines, deck beams and keel flush with the transom and glue on an overlay of 1/16-in. mahogany veneer, Fig. 2. When dry, trim the overlay to the form of the transom.

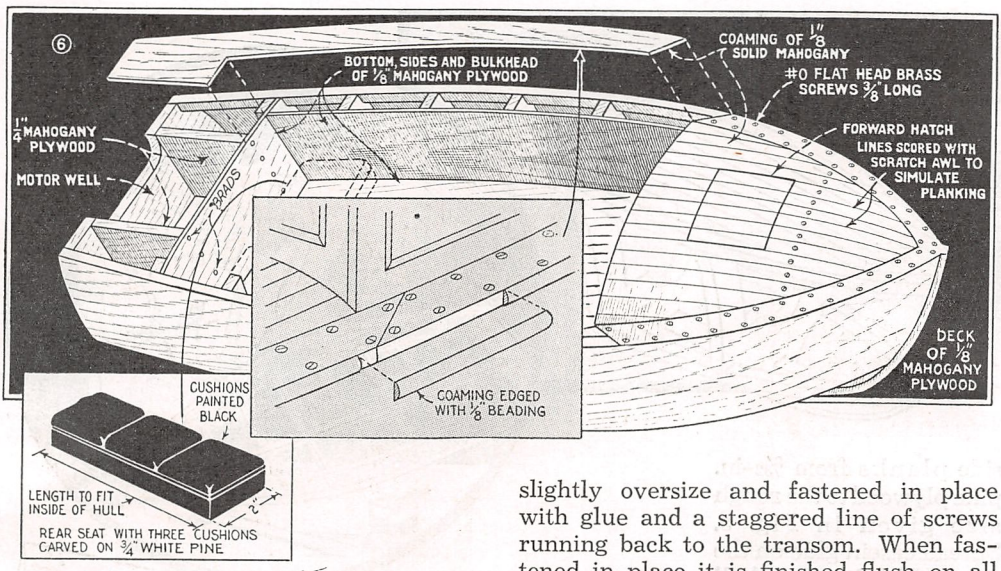
Next, the hull frame must be shaped up to take the side planking. This is done with a block plane and a fine wood rasp. A triangular filler block is cut from ¾-in. pine, 7½ in. long, and is fitted between the deck beams as in Fig. 4. A cross beam cut from ½-in. stock is fastened just back of the second frame so that the back edge will measure 10 in. from the stem as indicated. Saw the two

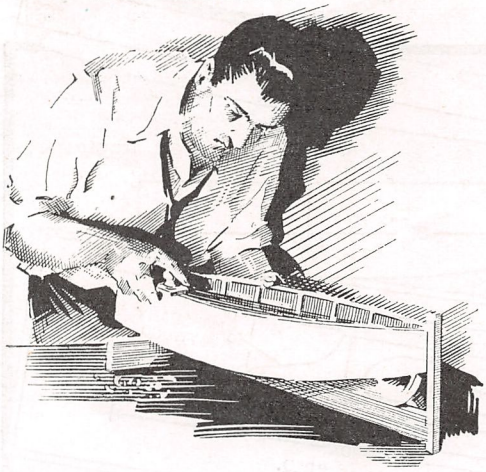


side planks from 3/32-in. pine plywood to the rough size given in Fig. 5. Spread casein glue on the chine, deck beam and all frames and clamp the plank to the hull. Begin at the forward end and join with No. 0 flat-head brass screws 3/8 in. long, first driving two screws about 1½ in. apart into the chine and deck beam between the first and second frames to hold the plank in position. Then trim and fit the end of the plank into the rabbet in the stem and join with screws spaced ½ in. apart. Proceed with a vertical line of screws driven into each frame, the screws being equally spaced about 5/8 in. apart. Then drive a line of screws into the chines and deck beams, spaced ¾ in. apart. While the sides are drying, cut and fit the forward deck which is 1/8-in. mahogany plywood. With plane and sandpaper crown the filler block and the cross beam 3/8 in., and finish flush with the deck beams all around. Spread glue over the entire surface and screw the deck in place, running the screws in two lines at the edge and staggered as shown.



Remove the screws holding the keel to the form and turn the hull upside down, clamping it to the bench top in any convenient position. Saw out the two bottom planks from 1/16-in. aircraft plywood to the rough size given in Fig. 5 and allow these to soak in lukewarm water for several hours so that they will bend more easily to the curvature of the bottom. Lay the straight edge of one plank against the side of the rabbet on the keel and run a line of screws from the stem notch back to the stern. Some trimming will be necessary in fitting the plank to the curvature of the stem, and the edge of the plank should be beveled with a sharp knife to a close fit in the rabbet. Drive the screws about ½ in. apart on the curve. Spread glue on the remaining surfaces and first drive a line





of screws spaced ¾ in. apart into each frame, working from stem to stern, then drive a line of screws into the chine, beginning at the forward end and working aft, spacing not more than ¾ in. apart. Finish the edges flush with the sides and drive a single screw through the keel into the transom, countersinking the screw hole and filling with a cold-water putty.

The bottom, sides, and the bulkhead that forms the forward end of the motor well are cut to size from ⅛-in. mahogany plywood. The bottom piece extends from the second frame back to the transom and should be a fairly close fit against the frame uprights. With all parts in place as shown in Fig. 6, the hull is completed with the coaming strip. The coaming strip is cut slightly oversize and fastened in place with glue and a staggered line of screws running back to the transom. When fastened in place it is finished flush on all edges with a fine rasp. After both strips have been applied, set a marking gauge to the width of the strips at the point where they join the deck and score a line on the edge of the deck to the bow, taking care that the lines do not extend beyond the point where they meet. Score heavy lines about 5/16 in. apart each way from a center line on the deck to represent planking, and also a square to simulate the forward hatch. The edge of the coaming from bow to stern is finished with a ⅛-in. beading fastened with glue and lill pins as in the enlarged detail of Fig. 6. The rear seat is a block of the dimensions and form shown which effectively imitates the cushions.

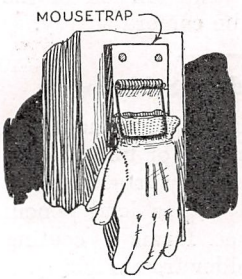
(To be continued)

Holes in Side of Kettle Aid When Draining Cooked Food

To prevent escaping steam from burning the hands and arms when draining a kettle of cooked food, drill several small holes in one side of the vessel just below the rim. The holes permit water to be drained off without sliding back the lid.—A. H. Waychoff, Tempe, Arizona.

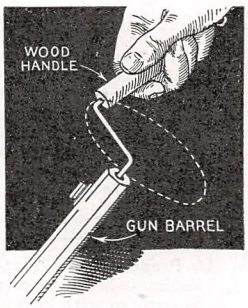
Mousetrap Used as Glove Holder

Conveniently screwed to the basement wall, a mousetrap provides a good holder for a pair of gloves that are worn while tending the furnace. The wrists of the gloves are slipped under the jaw of the trap, which holds them closed so that dust cannot get inside. The same idea can be used in a home garage where a pair of gloves are often kept on hand to wear while making minor adjustments on the motor or working on other greasy parts of the car.



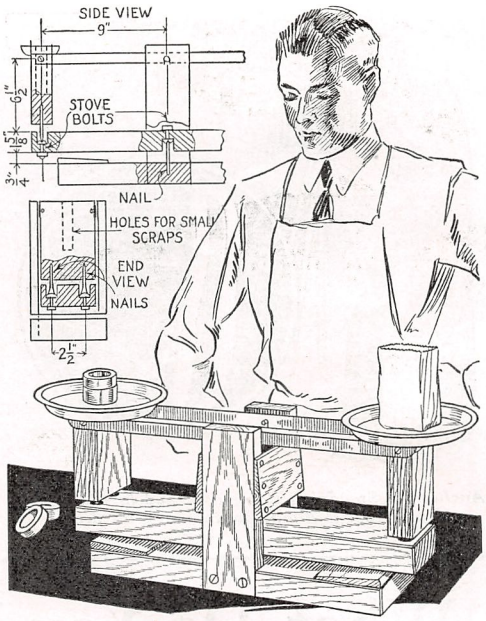
Cleaning a Rifle Barrel

To do a thorough job of cleaning a rifle, it is necessary to rotate the cleaning rod inside of the barrel. This is best done by bending the end of the rod at right angles as shown and providing it with a loosely fitted hardwood grip. With this simple alteration, the rod can be rotated with ease.



Sensitive Balance Scales Made from Scrap Parts

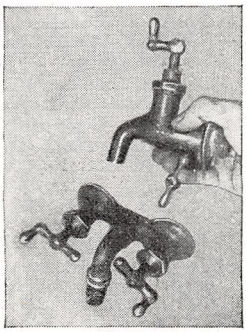
Amateur chemists and photographers will find these scales, which are made from scrap pieces of 2 by 4-in. stock, fairly accurate. Two end pieces are supported vertically by headless spikes, which rest in slots cut in the heads of stove bolts that have been countersunk in a wooden arm. The latter is similarly pivoted in the center to a base, which carries two fixed vertical supports. A couple of lengths of flat iron are pivoted loosely to the end pieces and are swung on pins set in the supports. After the scales have been balanced with shot or scrap pieces of metal placed in shallow holes drilled in the ends of the vertical pieces, tin pans are fastened in place for trays. Short pipe nipples filled with lead are used as weights. These are made the correct weight by drilling out some of the lead so that they correspond to standard weights or with a known quantity of some substance such as sugar. —Thurman A. Phillips, Chicago.



These Balance Scales Weigh Quite Accurately with Weights Made of Lead-Filled Pipe Nipples

Altering Faucet Handles to Make Them Easier to Operate

To provide easy manipulation of his water-faucet handles, one home owner altered them so that they operated with a crank action. One end of handles having only one cross bar was cut off near the center and then soldered vertically to the tip of the other end of the handle to form a crank. On handles that had two cross bars, one of them was sawed off and one of the pieces soldered vertically to one end of the remaining bar as shown.—Andrew Vena, New York.



Anchor for Steadying Camera Tripod in Wind Made from Rubber Band, Cords and Wire Stake

Rubber Band Holds Camera Steady on Windy Days

For holding a camera tripod steady in a wind, take a heavy rubber band and fasten two lengths of cord or light rope to it as shown. Tie one cord to the camera screw and the other to a wire stake. After setting the tripod, push the stake into the ground at an angle. The tension of the band will then hold the camera steady.

Lead Pencil Aids in Soldering

To give your soldering jobs a neat appearance without grinding or filing to remove excess solder, rub the surfaces where solder is not wanted with a lead pencil. Graphite in the pencil forms a coating which prevents the solder from sticking.

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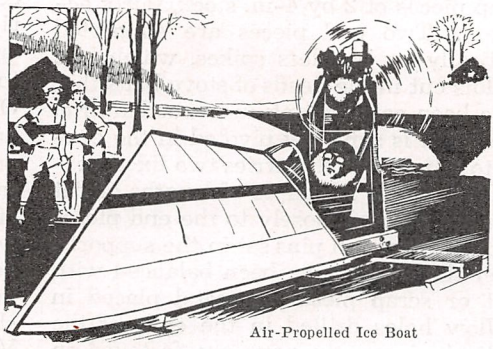
Price of blueprints is 25 cents each or six for $1.00. Address Blueprint Department, Popular Mechanics Magazine, 200 East Ontario St., Chicago.



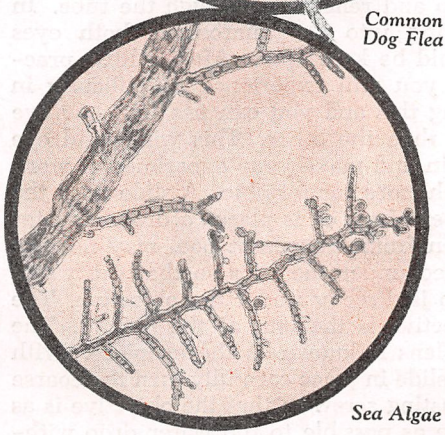
Air-Propelled Ice Boat

Exploring with a MICROSCOPE

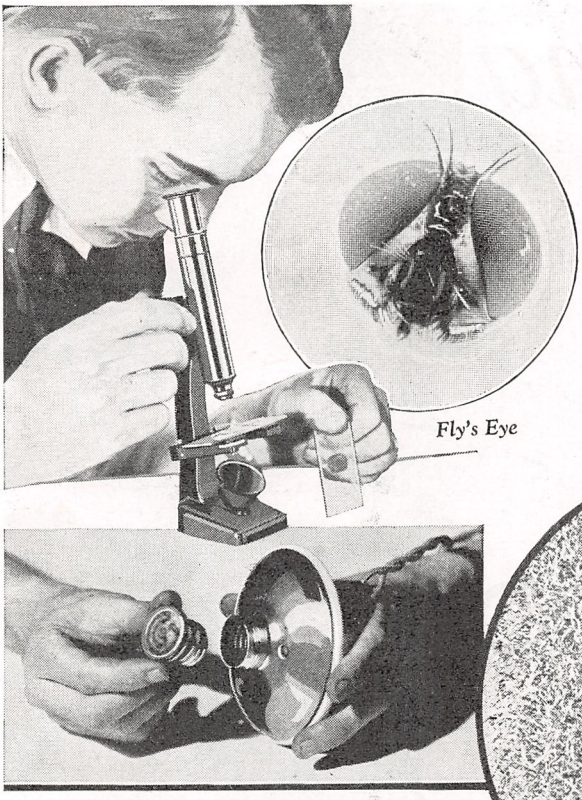
MICRO-ORGANISMS, as minute living bodies are called, are not only found in water, but they live in great numbers in the air we breathe, in the coal we burn and in the soil. An inexpensive compound microscope and a few homemade accessories are all that you need to make visible this vast unseen population. These tiny living things are not all there is for you to look at, for your microscope will also show you that even the finest particle of common salt or baking soda has been formed by nature into a more perfect and more beautiful crystal than the lapidary can ever hope to hew from the crude diamond or sapphire.

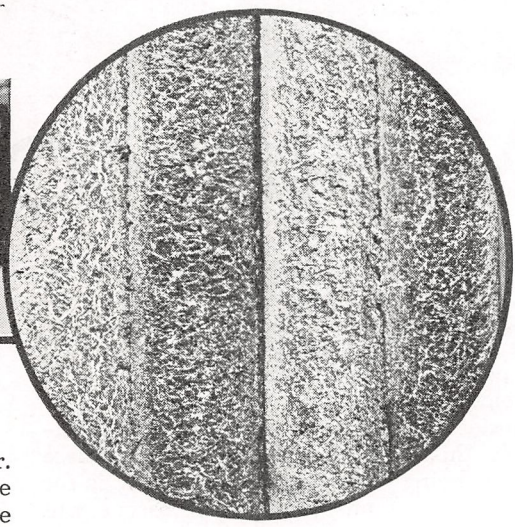
Regardless of the type of microscope you select, you will need a good microscope lamp. The homemade one shown was constructed from a square coffee can, a few scraps of tin from another can and an extension cord with its socket fastened to the can top so that the spherical part of the 25-watt frosted bulb is directly back of the 2½-in. hole. The ears which are shown soldered above and below the hole are to hold colored glass or celluloid filters so that the specimens may be viewed with whatever color of light is the most effective. An ordinary reading glass may also

Common Dog Flea



Sea Algae



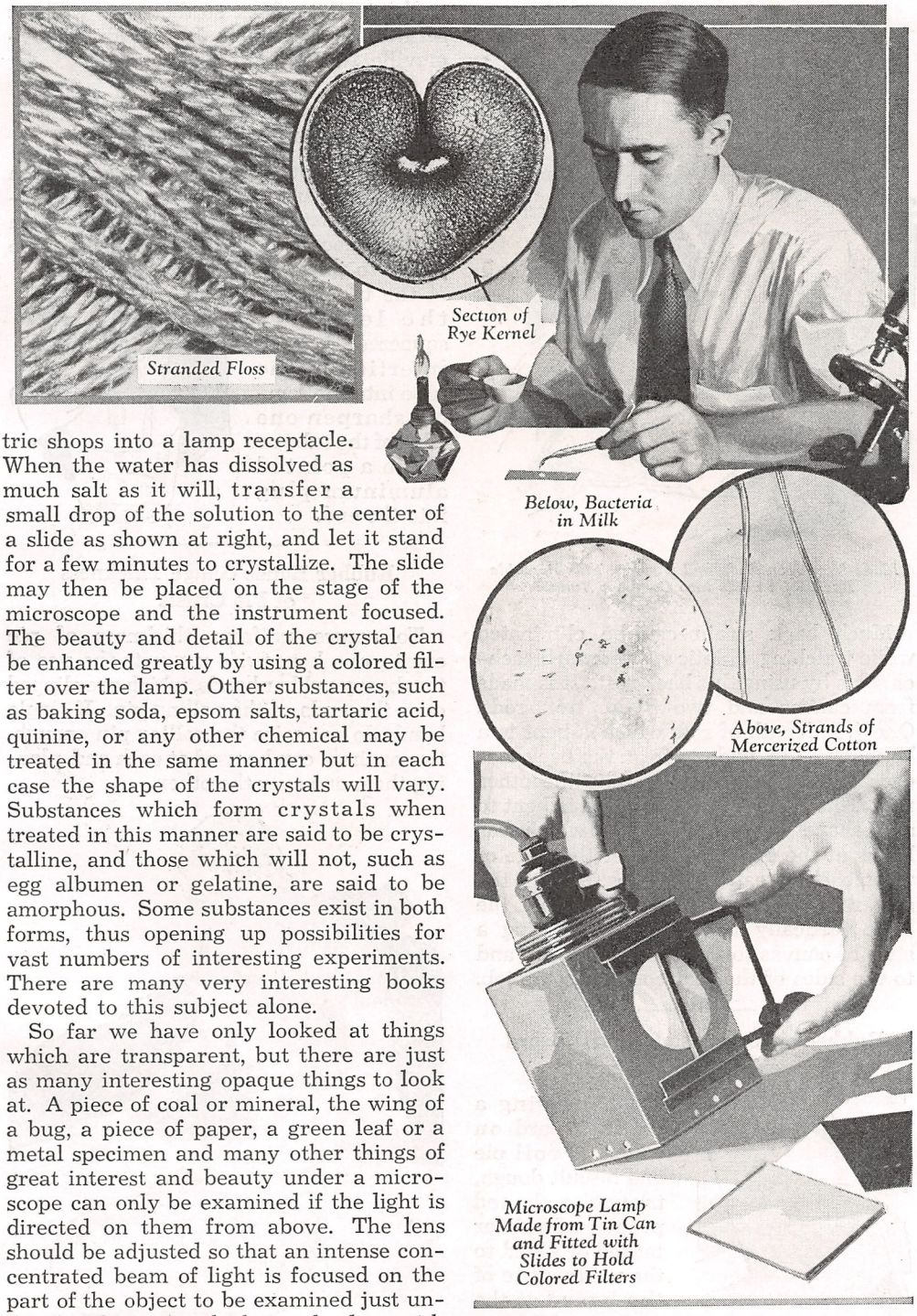


Specimen Heater Can Be Made from Cigar Lighter Screwed into Lamp Receptacle; Right, Cross Section of Pieces of Leather Seen through Microscope

be used to concentrate light on the mirror.

Set the lamp in front of the microscope and about 9 in. away, facing the adjustable mirror. While looking through the tube you can now easily adjust the mirror so that it picks up the beam of light from the lamp and reflects it through the tube. In looking into the microscope both eyes should be kept open. After a little practice you will experience no difficulty in doing this and you can use first one eye and then the other. This will avoid eye strain and make your experimental work much more comfortable. A slide upon the center of which is placed a drop of water taken from a stagnant pool may now be placed under the clips so that the water drop is directly under the objective. The objective is the lens at the bottom. The top lens is known as the eyepiece. With the slide in place carefully turn the coarse adjusting screw so that the objective is as close as possible to the water drop without touching it. Next look through the tube and turn the coarse adjusting screw slowly in the other direction, thus lifting the objective slowly until the living matter in the water drop comes into view. Focusing, as this operation is called, may now be finished by turning the fine or micrometer adjustment whichever way produces the best image. If focusing is started with the objective high above the slide there is danger of passing through the focusing point and jamming the lens against the slide which would very likely result in serious damage to the lens, which is the most valuable part of the instrument.

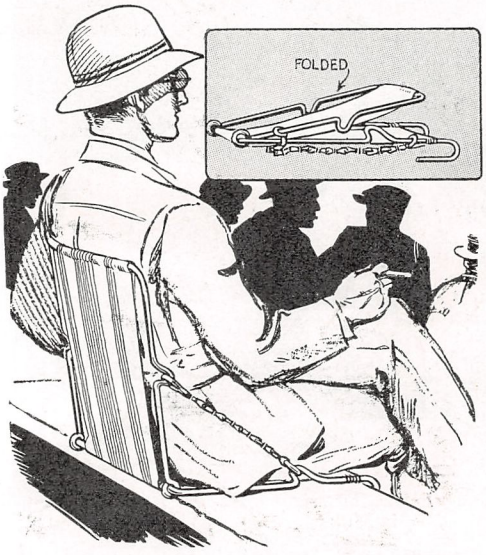
If your microscope is equipped with additional objectives try both the high and low power on the slide. With the microscope focused on the object try placing various colored filters in the lamp and note which produces the greatest contrast. By using the filters it is possible to bring into view objects which were entirely invisible or at best only vague with ordinary light. Beautiful crystals which appear as sparkling gems under the microscope may be made by crystallizing table salt upon a clean slide. To do this dissolve as much salt in a spoon or a small dish of hot water as possible. A handy heater for microscope work is made by screwing an electric cigar lighter such as is sold at almost all elec-



tric shops into a lamp receptacle. When the water has dissolved as much salt as it will, transfer a small drop of the solution to the center of a slide as shown at right, and let it stand for a few minutes to crystallize. The slide may then be placed on the stage of the microscope and the instrument focused. The beauty and detail of the crystal can be enhanced greatly by using a colored filter over the lamp. Other substances, such as baking soda, epsom salts, tartaric acid, quinine, or any other chemical may be treated in the same manner but in each case the shape of the crystals will vary. Substances which form crystals when treated in this manner are said to be crystalline, and those which will not, such as egg albumen or gelatine, are said to be amorphous. Some substances exist in both forms, thus opening up possibilities for vast numbers of interesting experiments. There are many very interesting books devoted to this subject alone.

So far we have only looked at things which are transparent, but there are just as many interesting opaque things to look at. A piece of coal or mineral, the wing of a bug, a piece of paper, a green leaf or a metal specimen and many other things of great interest and beauty under a microscope can only be examined if the light is directed on them from above. The lens should be adjusted so that an intense concentrated beam of light is focused on the part of the object to be examined just under the objective, which may be done with a reading glass. If you wish to experiment with colored light, a filter may be clipped over the lens, and another of a different color over the lamp for unusual effects.

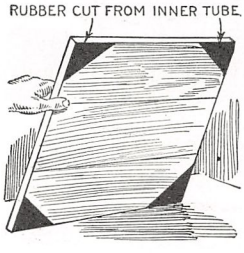
Back Rest for Bleacher Seats



Made from Iron Rods and Canvas, This Portable Back Rest Folds into Compact Bundle

Much back strain can be eliminated while watching athletic sports from bleacher seats by using this back rest. It is made from canvas and two ¼-in. iron rods. One 4-ft. length of rod, which is bent to a U-shape 14 in. wide to form the back, has eyes bent on the ends to take the other rod. This one is 4½ ft. long and is bent to a U-shape to form the seat, which has hooks at the ends to slip over the edge of the bleacher seat. Half loops, bent in the side rods, take short chains to hold the back vertically when in use. Sewing a strip of canvas to the top of the back and to the sides of the seat completes the job.

Rubber on Corners of Pastry Board Prevents It from Slipping



When using a pastry board on which to roll pie and biscuit dough, triangular shaped pieces of rubber tacked or glued to the underside of the board at the corners will keep it from sliding on the surface of the table. If tacks are used, they should be driven well into the rubber so that they will not scratch the table.—A. J. Calandra, Gloversville, N. Y.

Efficient Lemon Juicer Made from Aluminum Tube

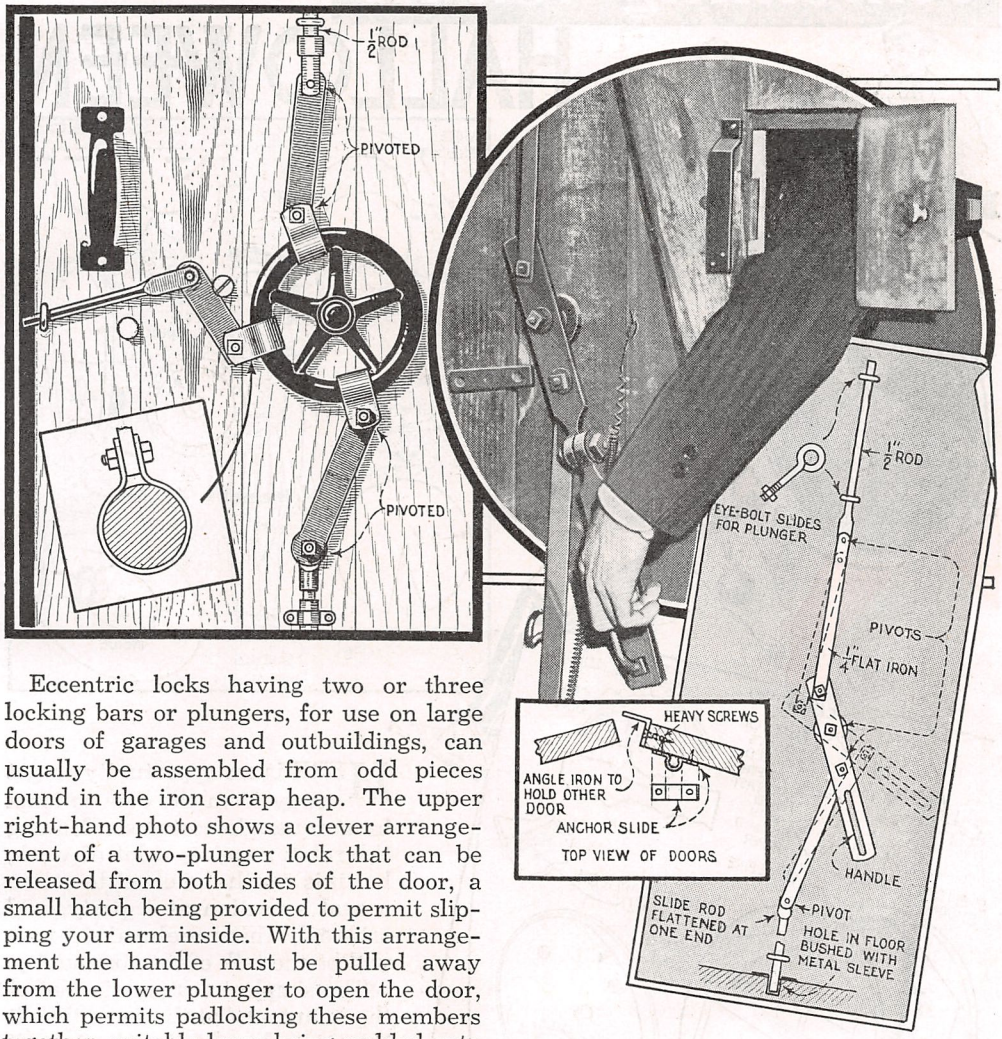
Pushed through the center of a lemon, a small aluminum tube serves as an effective juice extractor. The central portion of the tube is perforated to permit the juice to flow out of the tube when the lemon is squeezed. For easy insertion of the tube into the lemon, sharpen one edge of the tube or drive a pointed aluminum plug into the end.

Rubber Bands Gauge Thickness of Pie Crusts

To assure uniform thickness of pie crusts, one housewife suggests the use of two heavy rubber bands, which are slipped over the ends of the rolling pin. If single bands do not raise the rolling pin enough, two or three can be used at each end, placing them one over the other.

Narrow Rubber Bands Slipped over Ends of Rolling Pin Assure Uniform Thickness of Pie Crusts

Eccentric Locks to Hold Your Garage Doors

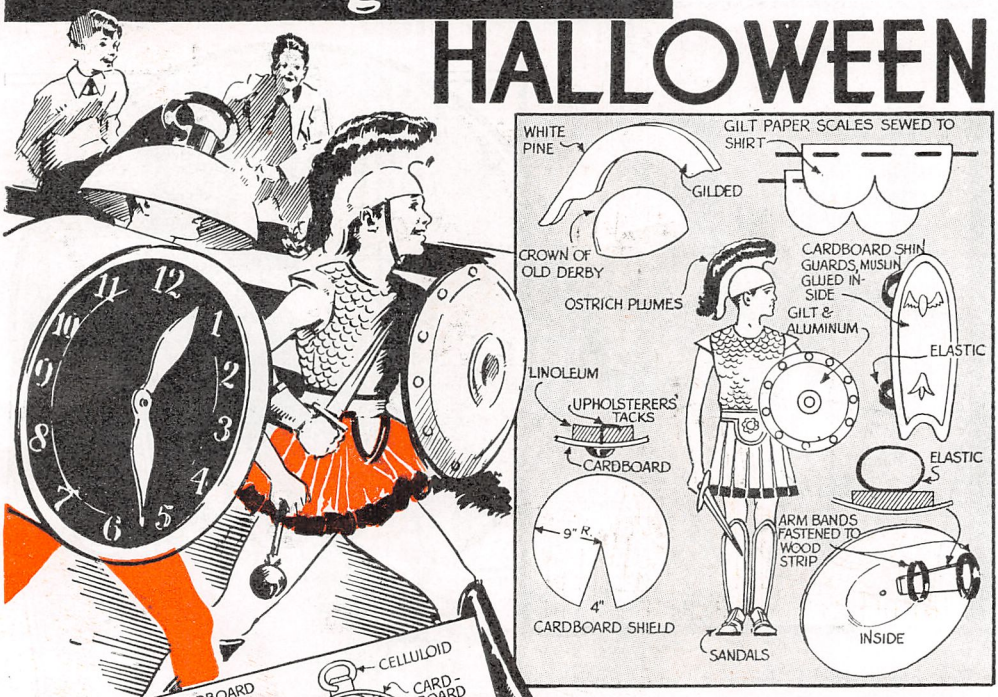


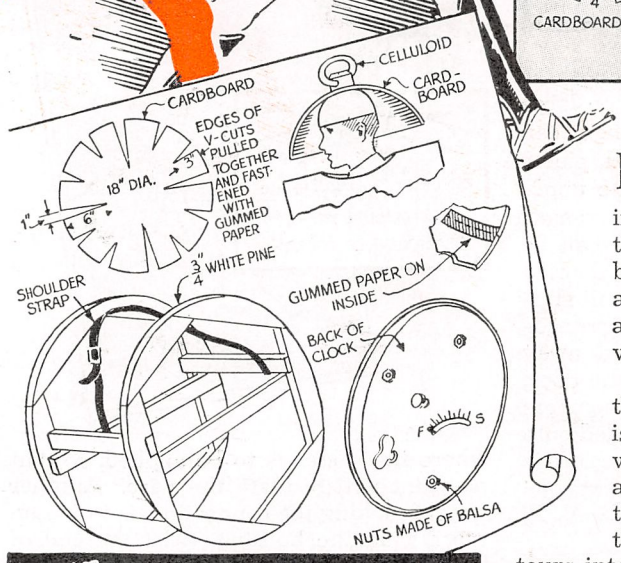
Eccentric locks having two or three locking bars or plungers, for use on large doors of garages and outbuildings, can usually be assembled from odd pieces found in the iron scrap heap. The upper right-hand photo shows a clever arrangement of a two-plunger lock that can be released from both sides of the door, a small hatch being provided to permit slipping your arm inside. With this arrangement the handle must be pulled away from the lower plunger to open the door, which permits padlocking these members together, suitable loops being welded onto them to take the padlock. At the left is shown a three-plunger arrangement, operated by means of a small wheel.—V. P. McMahon, Chicago.

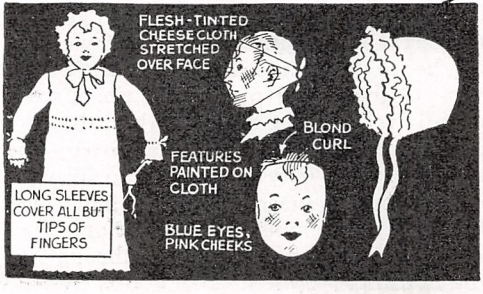
Protection against Electric Shocks from Motor-Driven Machines

Electric shocks from motor-driven equipment, such as washing machines, can be prevented by grounding the motor housing to a cold-water pipe. This is done best by soldering the bared ends of an insulated wire to the housing and to the pipe, first thoroughly cleaning the metal where the solder is to be applied, so that no paint will insulate the wire. Another way of making the connection, is to loosen a screw in the housing, twist the end of the wire under the head and then tighten the screw against it. A large battery clamp can be used to connect the other end of the wire to the water pipe. Electric current usually reaches the metal work of the machine in two ways: An insulated wire inside the motor may become bared through overheating or mechanical wear and touch the housing, or moisture in the motor may cause small currents to leak through to the housing.

Something New in HALLOWEEN







HERE is an opportunity to get away from the conventional in masquerade costumes. Making the robot requires a lot of work, but it is worth the effort to create a real sensation at a party, and assuredly this mechanical man will be the talk of the community.

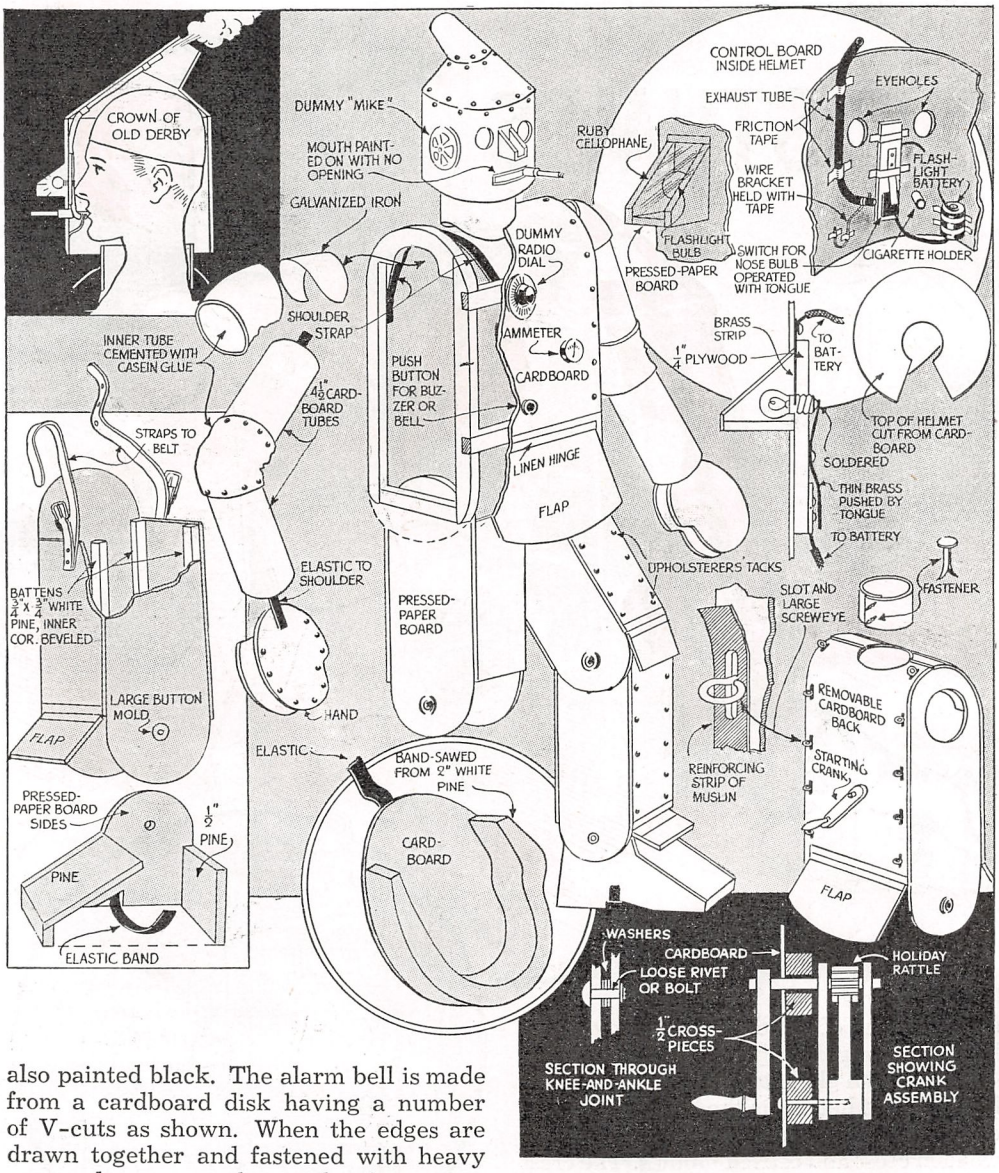
The simplest costume is that of the infant, and at the same time it is extremely effective, because it will completely disguise the age and sex of anyone. The flesh-tinted cheesecloth covering for the face rounds the mature contours into those of a child, and while the wearer can easily see and breathe through the cloth, the other guests cannot penetrate the disguise. Use white cheesecloth and give it the lightest flesh tint with commercial dye. When dry, stretch over the features and knot at the back, as shown. Then paint in eyes, eyebrows, nostrils and mouth with water colors, giving a touch of rouge on the cheeks. Brush the natural hair back to permit a high forehead, attach

COSTUMES

a blond curl of false hair and cover the head with a frilly cap tied under the chin.

The Roman gladiator costume is also effective. The helmet is the crown of an old derby hat surmounted with a curved wooden crest and ostrich plumes. The crest is scroll-sawed from ¾-in. white pine and tacked from the inside. Drive in large-headed tacks through a strip of reinforcing cardboard. A convincing coat of mail is made by sewing scales of gilt paper on an undershirt, the scales overlapping each other. Sew on paper or leather epaulettes, and make a belt of red and black oilcloth. The skirt should be an accordion-pleated white one with a red hem.

Two novel disguises, both easy to make, are the alarm clock and the tent. For the alarm-clock framing, use ¾ or ½-in. white pine, and cover with heavy cardboard, cutting an opening at the top for the head, and another at the bottom which is large enough to pass over the entire body. The frame is provided with shoulder straps for comfort. Give the clock a coat of ivory brushing lacquer and paint the numerals in black. Hands are cut from plywood and



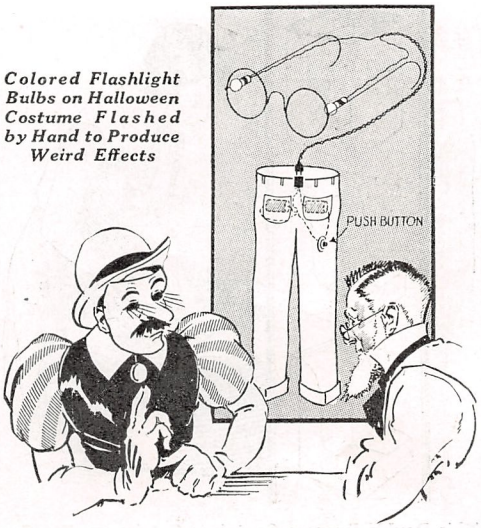
also painted black. The alarm bell is made from a cardboard disk having a number of V-cuts as shown. When the edges are drawn together and fastened with heavy gummed paper on the inside, the correct shape will be formed. The bell is fastened to the wearer's head by means of the crown of an old derby. The tent costume is a frame worn in the same way, and covered with unbleached muslin. It is light, roomy and well ventilated. When not moving about, the entire weight rests on the floor. Insert a panel of mosquito netting as indicated to permit sufficient visibility.

The animated sack of potatoes is sure to get a big hand. Sew up a large bag of muslin and stencil on a design. The wearer gets in and stands with feet apart while assistants pack rubber balloons, partly inflated, around him, in order to make the sack lumpy. Stitch the top with cord, arranged so that the user can open it instantly with a jerk if necessary.

You will have plenty of fun with the smoke-belching robot, which may be equipped with as many fun-making gadgets as you can devise. In making the robot, the frame must, of course, be fitted to the wearer, and should be made as large as

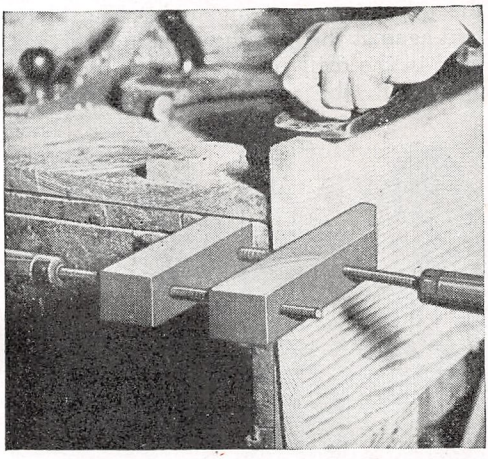
possible to permit freedom of movement. The helmet, collar, coat with sleeves, and the legs are separate units for ease in putting on and taking off. The sleeves are made up of cardboard tubes with rubber joints. They are supported at the shoulder on a curved piece of sheet iron as shown. The wearer draws on the legs with shoes attached and adjusts them to his belt. Next he gets into the coat through the open back, which is attached by means of screw eyes in slots, a quarter turn locking each. An amusing feature will be a crank at the back, operating a holiday rattle on the inside. On the front of the coat other devices can be installed, such as radio dials, ammeters, push buttons, etc. The last could be made to sound a real buzzer, with a flashlight battery fastened to the frame of the coat, inside.

To make your halloween costume spooky, mount small colored flashlight bulbs on a wire frame shaped similar to a pair of glasses and wear it under your mask. Wire the bulbs to a flashlight battery concealed in a pocket of the costume and provide a push button to control the lights. A still more novel effect can be had by using two push buttons so that the lights can be controlled individually. Besides the method illustrated, the lamps may be used to simulate flashing stickpins, red stoplights on your coat tail, brilliant cuff buttons and many other variations.



Colored Flashlight Bulbs on Halloween Costume Flashed by Hand to Produce Weird Effects

Bench Vise Quickly Improvised from Woodworkers' Clamps

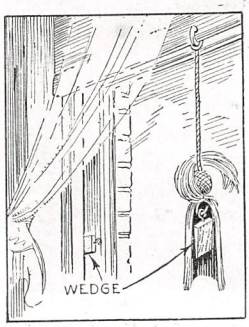


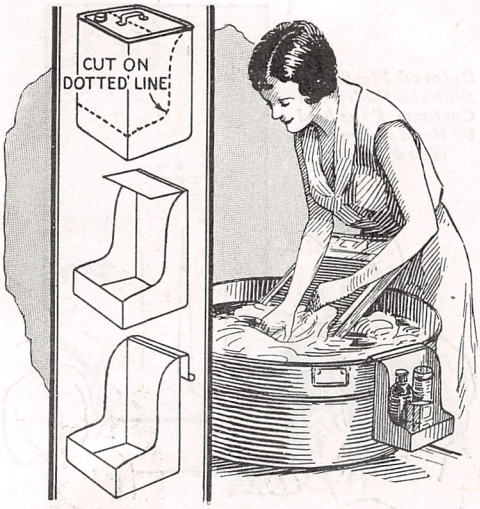
Woodworkers' Clamps Fastened to End of Workbench Serve as Emergency Vise for Large Panels

In the absence of a woodworkers' vise in the home workshop, one can be quickly improvised from a pair of wood clamps as indicated. Merely cut a square hole in the side of the workbench, near the end, to take one of the clamp jaws. In this way, the bench serves as the stationary vise jaw. A vise of this kind is especially handy for holding large plywood panels.

Window-Shade Tassel Hides Wedge Used to Quiet Sashes

To assure that a small wooden wedge used to prevent window sashes from rattling would be at hand when needed, one home owner fixed the tassel on the window shade to hold the wedge as shown. A small screw hook was driven into the body of the tassel to take a screw eye in the wedge. When hung on the hook, the wedge is completely covered by the tassel and is quickly removed for use.—L. H. Georger, Buffalo, N. Y.





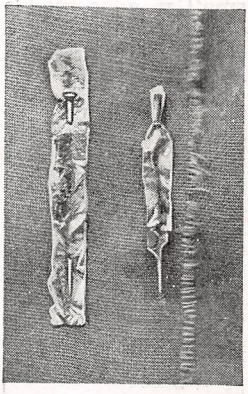
This Double-Purpose Container Cut from a Tin Can Will Prove Helpful on Wash Day

Container Holds Laundry Articles on Side of Washtub

Many steps can be saved on wash day by placing various laundry accessories in a container cut from a square tin can and hung on the rim of the tub as indicated. A container of this kind may also be used to hold clothespins as it can be hooked over the line and pushed along.

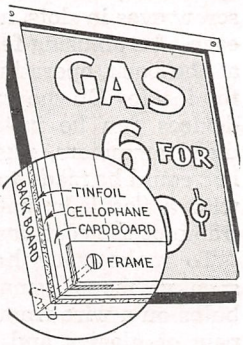
Tinfoil Locks Common Pin in Place

Wrapped around the ends of a pin, a piece of tinfoil from a cigarette or tobacco package will help to prevent the pin from working out of light or loosely woven cloth. Cut a piece of foil ½ in. wide, and ½ in. longer than the pin. Fold it together until it is approximately ⅛ in. wide, and run the pin through it as shown at the left. Then press both ends of the foil tightly around the pin as in the right detail. A pin locked in this way will hold despite strong pulls and jerks.—F. W. Bentley, Jr., Missouri Valley, Ia.



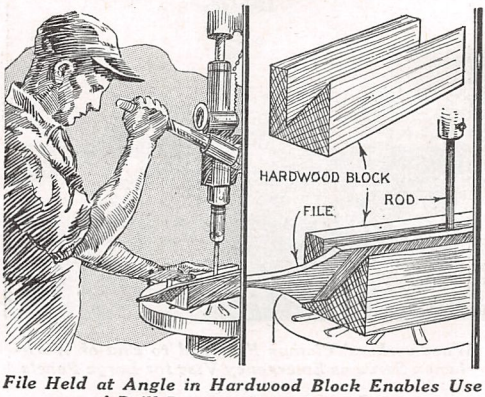
Sign Illuminated by Light from Cars

When mounted on a post along the roadside, light reflected from car headlamps illuminates this sign. A stencil of the desired lettering is cut from cardboard or sheet metal, preferably the latter, after which it is backed with clear Cellophane. If desired, small pieces of colored Cellophane can be glued to the stencil behind the letters. Next, tinfoil is placed behind the Cellophane to serve as a reflector, after which the whole assembly is put in a wood frame and backed with plywood. If a dull black finish is applied to the stencil it will make the letters stand out conspicuously.



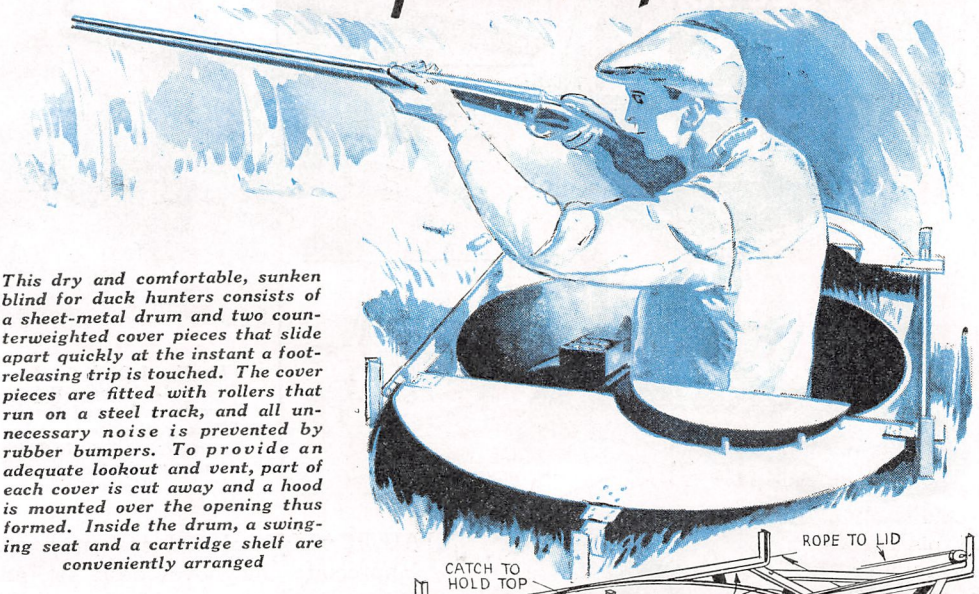
Iron Rods Pointed with Drill Press

For pointing iron rods quickly with a drill press, an Arizona blacksmith uses a hardwood block, grooved to hold a file. One side of the groove is vertical while the other is cut at an angle. The file is laid against the slanting side, and the rod, held in the drill-press chuck, is fed down against it, the vertical side serving the purpose of a steadyrest for the rod. Obviously, the angle of the point depends on the angle of the file and can be varied by changing the groove to suit.—A. H. Waychoff, Tempe, Ariz.

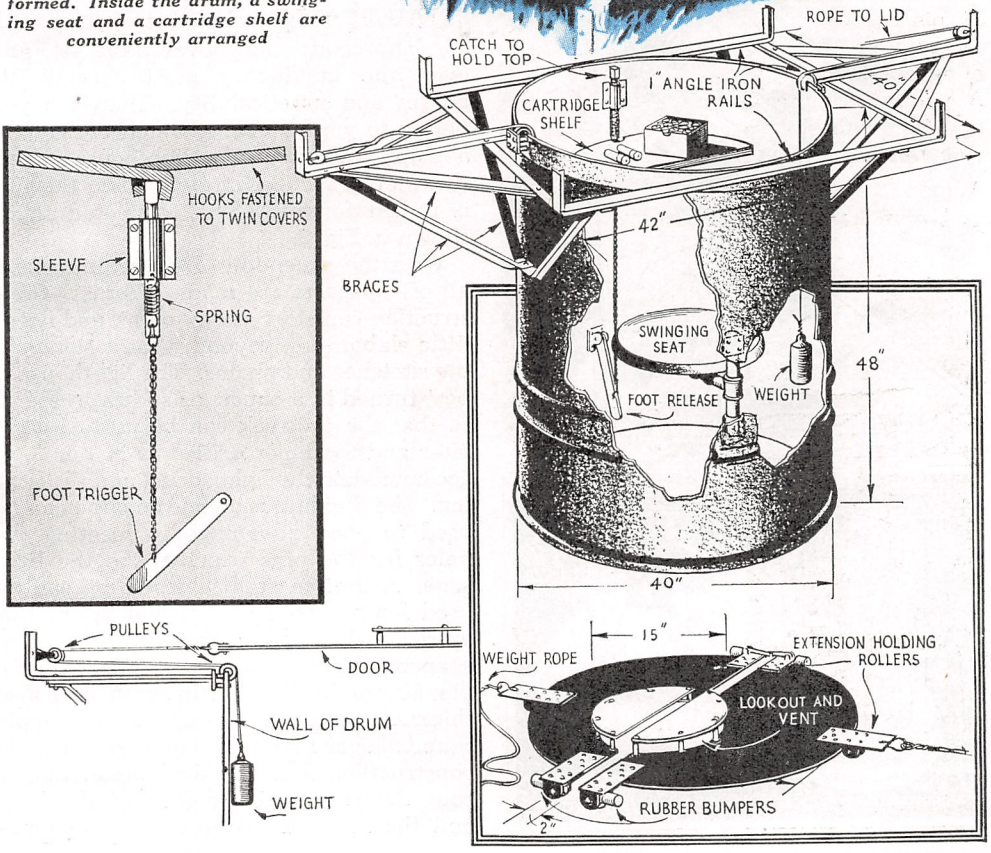


File Held at Angle in Hardwood Block Enables Use of Drill Press to Point Iron Rods

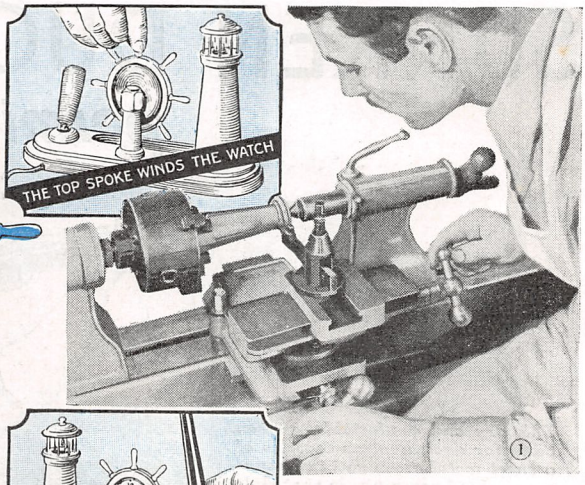
SUNKEN DUCK BLIND
permits quick action

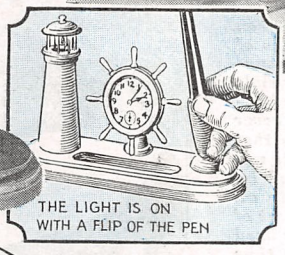


This dry and comfortable, sunken blind for duck hunters consists of a sheet-metal drum and two counterweighted cover pieces that slide apart quickly at the instant a foot-releasing trip is touched. The cover pieces are fitted with rollers that run on a steel track, and all unnecessary noise is prevented by rubber bumpers. To provide an adequate lookout and vent, part of each cover is cut away and a hood is mounted over the opening thus formed. Inside the drum, a swinging seat and a cartridge shelf are conveniently arranged

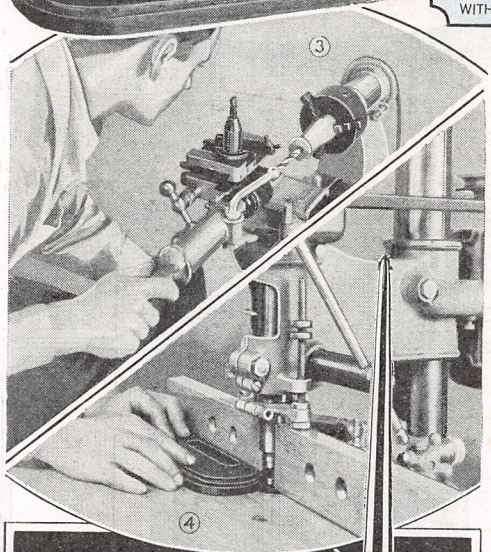


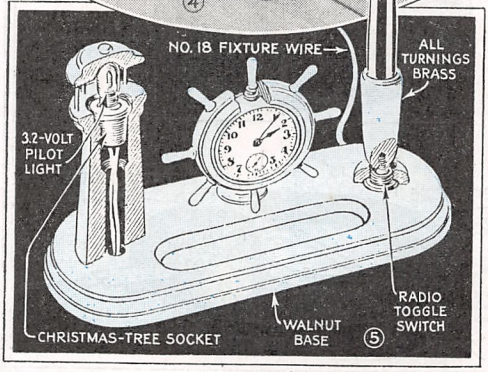
A Sea-Goin' DESK SET





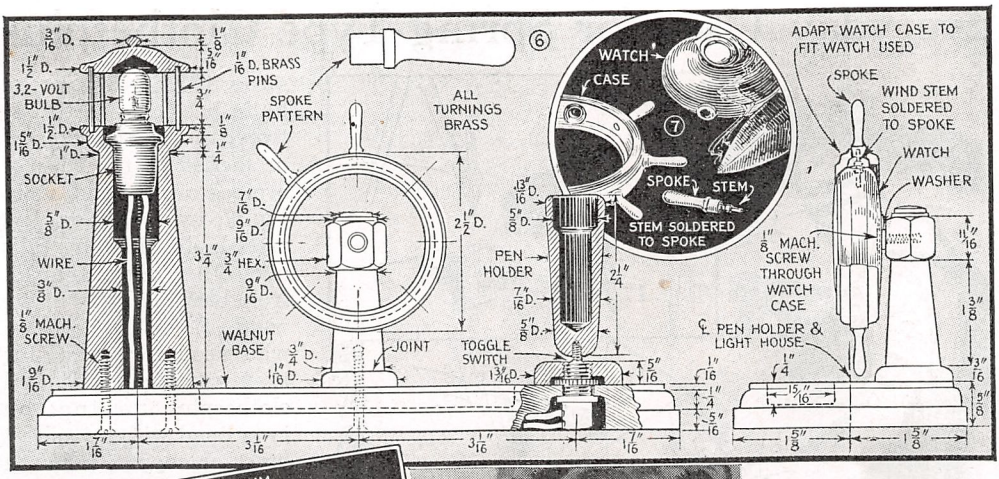
This Novel Desk Set Features a Lighthouse Whose Beacon Is Turned On by Flipping the Penholder Forward; the Unit Is Quite Attractive in Brass and Walnut

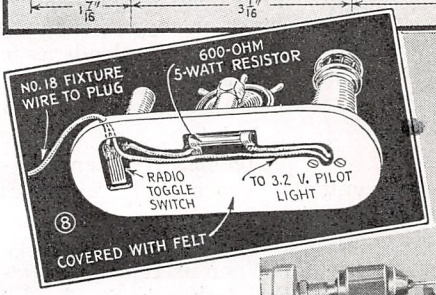


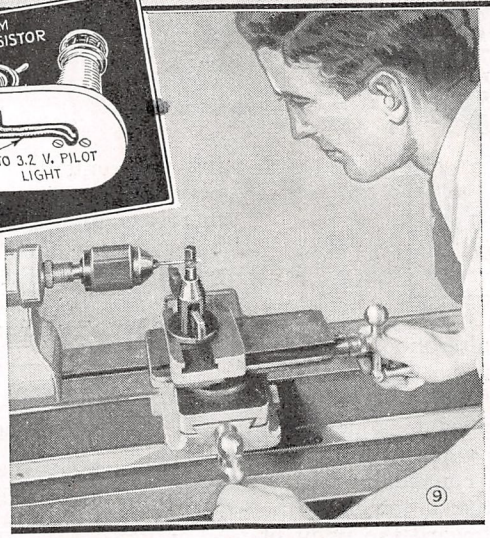


NAUTICALLY minded craftsmen will appreciate this novel desk set, and even the landlubber must concede its charm and practicability. There's a pen handy to your touch, a watch encased in a ship's wheel, and a lighthouse which throws out a cheerful glow when the pen is pulled forward. The completed set is shown in Fig. 2.

With the exception of the walnut base, all of the parts are made of brass. Construction can start at any point, and needs little elaboration beyond what is shown in the sketches and photos. The lighthouse is best turned in a chuck, as shown in Fig. 1, so that the tailstock can be pushed aside later and the holes drilled as in Fig. 3, to accommodate the light socket and the wiring. The dividing head on the lathe can be used to good advantage in locating the holes for the pins which make the light cage. A section from a test tube can be used for a glass frame if you desire this extra touch. Fig. 4 shows the base being shaped on the drill press. The over-all dimensions are 9 by 3¼ in., with a finished thickness of ⅝ in. The edge can be simply rounded over if you wish an easier form of construction. Use the drill press, too, to rout the recess in the face of the base and the recesses necessary to accommo-







date the wiring and electrical fittings.

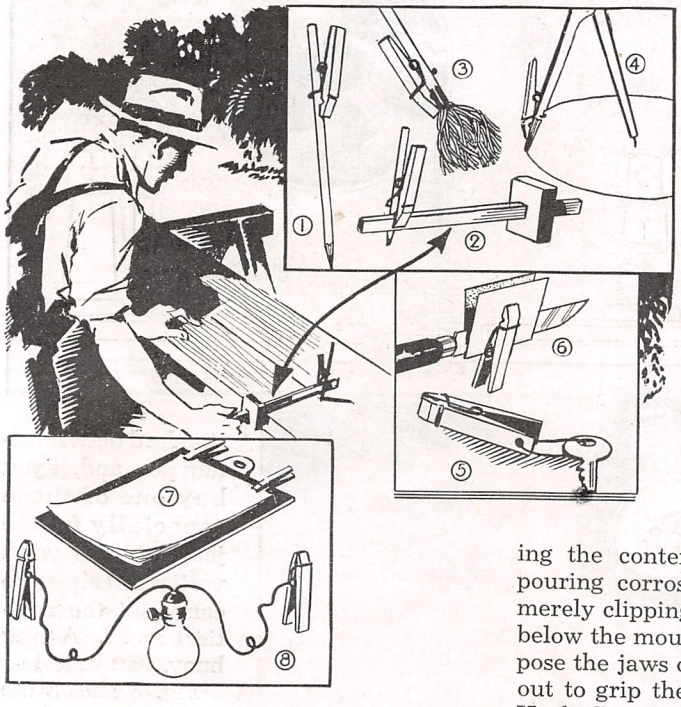
As can be seen in Figs. 5 and 6, the original case around the winding stem of the watch is cut away, and the top spoke of the wheel is soldered to the stem as in Fig. 7. The hole for this spoke through the watch case should be a loose fit so that the stem can be pulled out slightly for setting the watch. All of the other spokes are a tight fit in their respective holes. No exact dimensions can be given for the watch case, as this is dependent on the watch which you will use. The manner of mounting is by means of a ⅛-in. machine screw, which is inserted through the back plate of the watch, after first grinding the head down very thin. The light control is very simple—merely a radio toggle switch which also serves as a mounting for the penholder. The switch lever should be cut down and threaded to fit a corresponding tapped hole in the small end of the penholder turning. Bore the inside of the holder out to take a standard desk fountain pen, and, if you buy one of these especially for the job, get one with vertical stripes to carry out the nautical motif. A spar buoy, you know!

Fig. 8 shows the wiring. The resistor takes care of the usual 110-volt power line when used in connection with a 3.2-volt pilot light of the kind used on radios, and gives good illumination although it is in no sense a desk lamp all in itself. Fig. 9 pictures another operation in the turning—forming the wheel spokes. These are easily made by using 3/16-in. brass rod held in a drill chuck. Before assembly, buff the work to a brilliant polish with tripoli or rottenstone, and then spray with clear lacquer to hold the finish.

Testing Eggs for Freshness

An egg can be tested for freshness by dropping it in a cupful of water in which salt, 2 tablespoonfuls, has been dissolved. If the egg settles to the bottom, it is fresh, but if it remains suspended between the top and bottom of the solution, it is four or five days old. If it floats, it probably has been in storage.

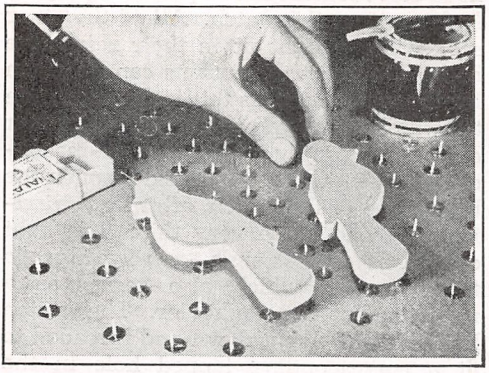
Everyday Uses for Spring-Type Clothespins



With a few slight alterations ordinary spring-type clothespins can be put to numerous uses. Fig. 1 shows how half of a clothespin can be clipped to a pencil to serve as a pencil clip, while in Fig. 2 the same idea is used in connection with a marking gauge. In the latter case the clothespin is pushed toward the point of the pencil. The gauge is then set and lines can be marked parallel to the edge against which the gauge block rides, as shown in the illustration. A 10 or 12-in. handle fitted with half of a clothespin to hold a wad of cloth firmly, as shown in Fig. 3, makes a practical milk-bottle washer. One leg of a large, wooden compass may be fitted similarly to hold a chalk crayon, as in Fig. 4, which is handy for scribing circles on blackboards. Keys to outbuildings often are misplaced or lost, and to avoid this you can tie the key to a clothespin, Fig. 5, which may then be snapped to some convenient support. Fig. 6 shows how a knife sharpener is improvised by folding a strip of sandpaper with the sanded surfaces together over the knife blade. Then clip a clothespin over the paper, as shown, and draw the knife back and forth between the paper. Screwed or tacked to the edge of a piece of plywood, as in Fig. 7, two clothespins will hold shipping bills and other memoranda from blowing away in the wind. Electrical workers who need "jumpers" for testing, etc., will find clothespins, having the jaws lined with thin sheet brass or copper, soldered to the testing leads as in Fig. 8, a quick method of making connections. Also, a test tube may be held conveniently when heating the contents over a flame or when pouring corrosive or poisonous acids, by merely clipping a clothespin around it just below the mouth. When used for this purpose the jaws of the clothespin may be cut out to grip the tube securely.—J. G. Van Hook, Somerset, Ky.

Thumb Tacks Aid in Drying Small Painted Articles

Small articles that require painting on both sides can be dried without smearing the painted surfaces by placing them on the pointed ends of thumb tacks arranged on a flat surface. A pin pushed in the edge of each article aids in handling them.



Thumb Tacks Support Small Painted Articles to Dry without Smearing the Wet Surfaces

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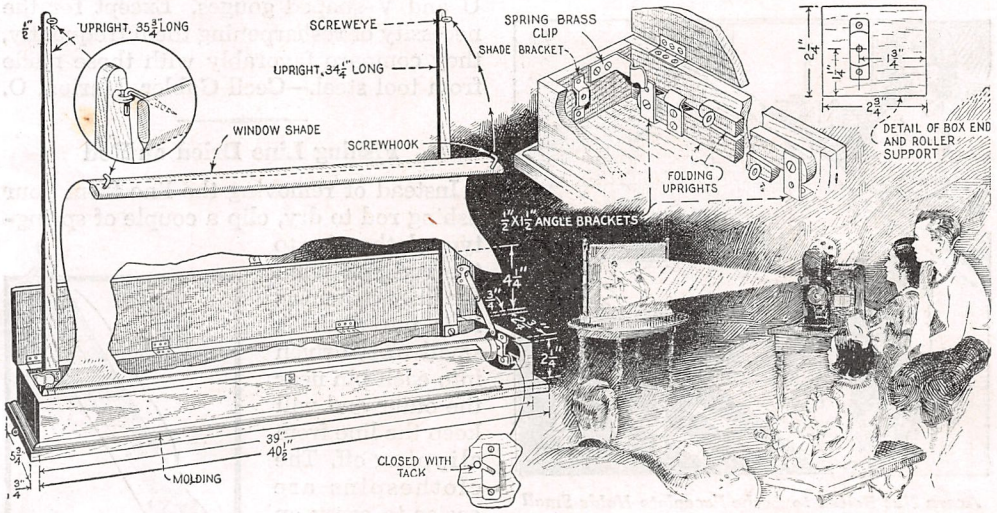
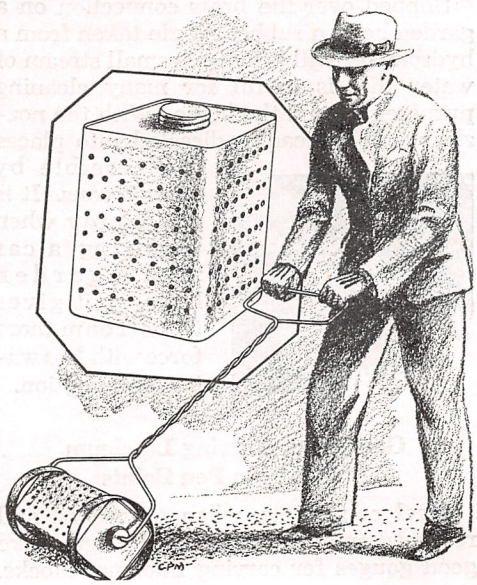
Home-Movie Screen Folds into Wood Case



Folding into a neat wood case, fitted with a hinged cover, this portable home-movie screen can be set up quickly on any chair or table. The screen is a 36-in. white window shade set in brackets screwed to the ends of the case. To prevent the end of the roller held by the slotted bracket, from slipping out of place, the slot is closed with a tack. Pivoted uprights that fold into the box support the screen, screw hooks in the shade fitting into screw eyes on the uprights. Note that the uprights are pivoted at their lower ends to angle brackets, and that the pivot point of one is higher than that of the other to permit them to lay horizontally, one on the other. To keep them up vertically, spring-brass clips, made as shown, are effective, one part being screwed to the case and the other to the upright.

Rolling Sifter Applies Even Coat of Ashes to Icy Sidewalk

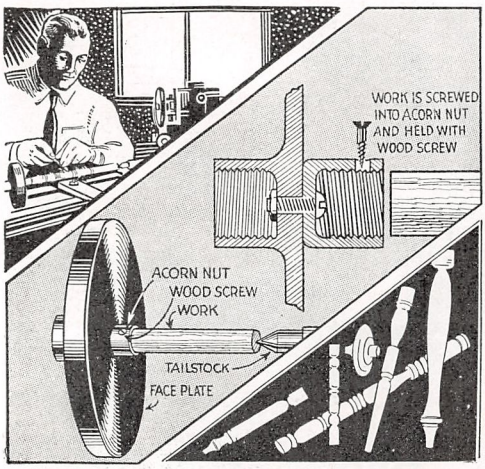
For spreading salt or ashes to prevent accidents caused by slipping on icy sidewalks, this sifter applies an even coating. It is made from a square tin can perforated on all four sides, and fitted with heavy metal bands at the ends so that it can be rolled over the walk. A handle for pushing the sifter is made by doubling and twisting heavy wire, a square loop for a hand grip being provided and the ends bent to fit holes in the ends of the can.



Small Grease Gun Improvised from Tooth-Paste Tube

When refilling small grease cups that are hard to reach, get an old tooth-paste tube, remove the crimped strip on the lower end, and fill the tube with cup grease. After replacing the strip, you can fill the cups by squeezing the tube.

Lathe Set-Up for Turning Small Wood Spindles



Acorn Nut Bolted to Lathe Faceplate Holds Small Stock When Turning Tiny Model Parts

To turn small wood spindles for models, an acorn nut can be attached to the faceplate with a stove bolt as shown. The nut is drilled in the side for a wood screw, which holds the work. By using different sizes of nuts, it is possible to turn spindles as small as a match provided the turning tools are handled carefully.

Hydrometer Nozzle Directs Small Powerful Stream of Water

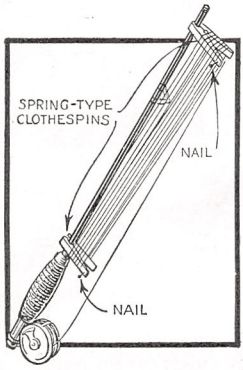
Slipped over the brass connection on a garden hose, a rubber nozzle taken from a hydrometer will produce a small stream of water that is useful for many cleaning purposes around the home. With the nozzle, water is readily directed into places inaccessible by other means. It is also handy when washing a car with a garden hose, as it gives the stream more force with less water consumption.

Gouges for Carving Linoleum Blocks from Pen Points

Steel pen points, when sharpened and reversed end for end in the holder, make good gouges for carving linoleum blocks. If a point of relatively soft steel is used, it is possible to reshape the curve to make U and V-shaped gouges. Except for the necessity of resharpening them frequently, they compare favorably with those made from tool steel.—Cecil Gabler, Marion, O.

Fishing Line Dried on Rod

Instead of removing the line from your fishing rod to dry, clip a couple of spring-type clothespins to the rod and wind the line on them as it is unreeled. A small nail driven into each pin near the outer end will keep the line from slipping off. The clothespins are easier to carry on a fishing trip than a drying reel, and save time.



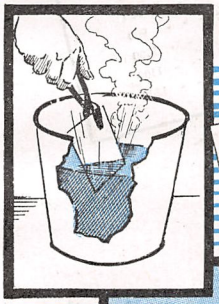
Rubber Cup on Clothes Stick Prevents Scalded Hands

Women who have suffered scalded hands when lifting clothes from a tub of boiling water with a clothes stick, will find that a rubber suction cup, such as used by plumbers, will prevent these accidents. Hot water running down the stick is caught by the cup and deflected into the tub. This arrangement may also be used when washing windows to prevent water from running down the brush handle.

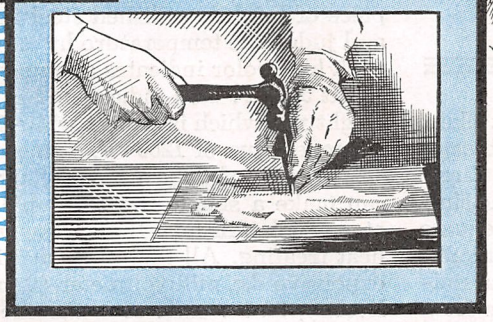
Plumbers' Rubber Suction Cup Slipped over Clothes Stick Prevents Boiling Water from Scalding Hands

HEAT - - - TREATING

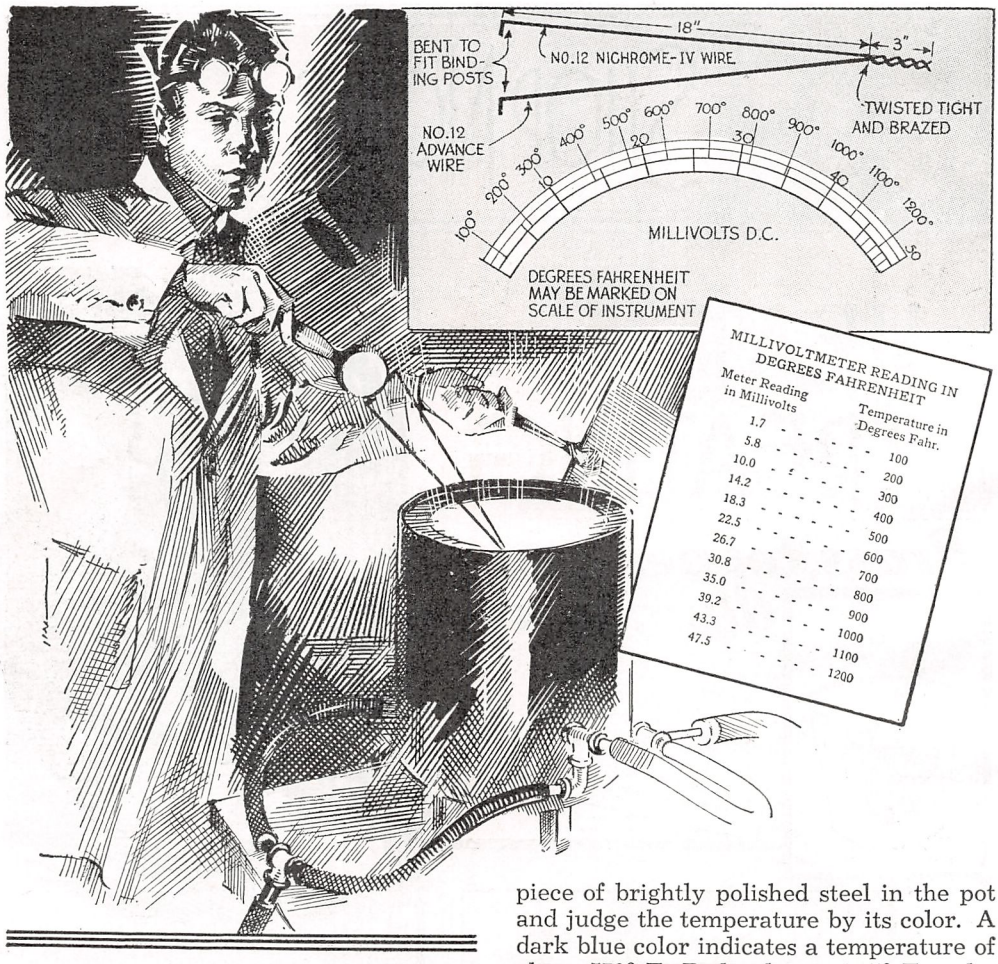
Brass, Copper and Aluminum



Brass, copper and aluminum made hard and brittle by hammering, bending and other shop operations, are restored to their former softness by annealing

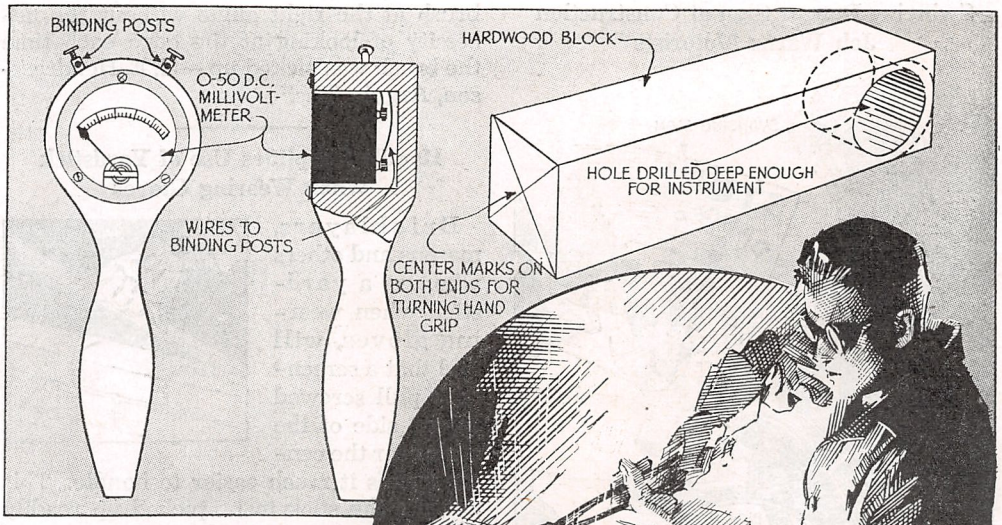


METALS such as brass, copper and aluminum frequently become hard and brittle, either due to hammering or other severe shop operations, and unless they are properly annealed or softened, they will break or tear and spoil a good job. All of these metals and most of the common alloys except aluminum and its alloys can be softened to some extent by simply heating them and either allowing them to cool in the air or plunging them into cold water; however, there are a few tricks which make this work a lot simpler and more effective. With some metals like aluminum and aluminum alloys, annealing by simply heating in an open flame is not satisfactory because of the action of the fuel on the metal and also because of the danger of overheating and spoiling the job entirely. Where tarnish formed during the heating will cause no trouble, copper and brass may be softened sufficiently for most purposes by heating them to a dull red heat and either cooling in air or plunging into cold water. The metal should be heated in a furnace or on a hot plate so that all parts are equally heated. A better plan, if convenient, is to heat the work in a simple furnace. An outfit of this type is quickly assembled by building a shield of brick



or asbestos board around a gas hot plate. A sheet of steel placed over the burner prevents the flame from coming in direct contact with the work. Although the simple procedure just described is adequate for ordinary purposes, it is better practice to heat brass and copper as well as aluminum in a furnace as free as possible from gases. It is also equally important that the temperature to which these metals are heated be rather accurately controlled. The easiest method of heating to get these results is by placing the work in a closed metal container such as a thick-walled iron pot fitted with a lid and to place this in a furnace such as described in the November, 1932, issue of Popular Mechanics. To prevent overheating, some method of measuring the temperature inside the iron pot is essential. The easiest plan is to place a piece of brightly polished steel in the pot and judge the temperature by its color. A dark blue color indicates a temperature of about 570° F. Red indicates 725° F. and a bright red which is almost white indicates a temperature of 1200° F. or more.

At a cost of only a few dollars anyone can make a simple thermocouple pyrometer which will take the guesswork out of heat treating. All that is needed is an inexpensive d.c. millivoltmeter (0 to 50 millivolts), 21 in. each of Nichrome IV and Advance resistance wire and two binding posts. Dimensions for the handle will depend upon the size of the meter. The binding posts are connected to the meter posts inside the case. Heavy wires should be used for this and they should be well soldered. The bent ends are inserted in the binding posts and tightened and the instrument is ready to use. It may be tested by placing the joined ends of the wire in the flame of a burner for a few minutes. If the meter needle moves in the wrong



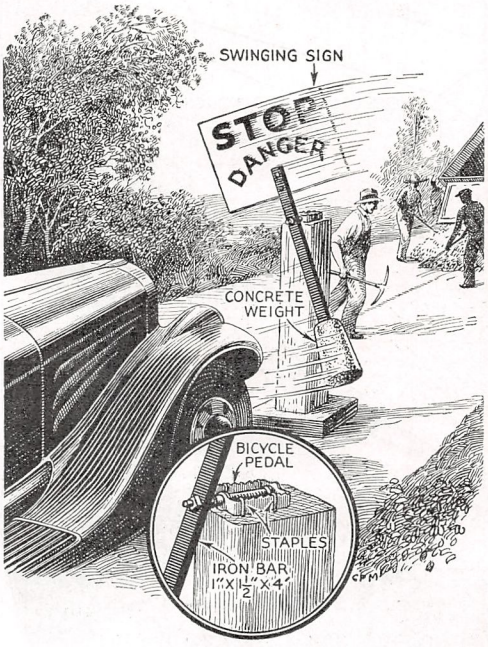
SOLIDIFYING TEMPERATURES OF METALS USEFUL FOR TESTING PYROMETER

Metal	Degrees Fahr.
Tin	449
Lead	621
Zinc	787
Aluminum	1220

direction simply interchange the wires at the binding posts. One of the drawings shows a millivoltmeter scale marked with temperatures at approximately the proper points. The glass cover may be removed and the values marked on the scale, or millivolt readings may be taken and converted into temperature by glancing at the table. The figures given are average values and will be found close enough for many purposes. However, if more accuracy is desired the instrument should be calibrated by placing the couple in molten tin and allowing the metal to cool slowly. As cooling progresses the meter reading will slowly drop until the metal starts to solidify. At this point the needle will remain stationary until all of the tin has solidified, after which it will again continue to move toward zero. The point at which the needle remained stationary during the solidification of the metal should be recorded as it indicates a temperature of 449° F. Other accurate temperatures may be located on the pyrometer by performing a similar test with other metals, solidifying temperatures of which are given in a table. These points may be marked on the instrument scale and intermediate temperatures found by dividing up the space between them.

Aluminum is annealed by heating it in a closed container placed in a furnace or oven to a temperature of 650° F. The work is slowly heated until all parts have had time to get to this temperature. The thermocouple may be inserted into the heating pot from time to time and as soon as the temperature reaches 650° F., the burners should be cut down to hold this value until all parts are heated. Some care is required in controlling the furnace to prevent overheating. The common aluminum alloys are treated in the same manner. For the best results with brass, follow the same methods as described for aluminum except that the temperature should not exceed 1112° F. for ordinary grades. Copper may be similarly annealed at 1202° F.

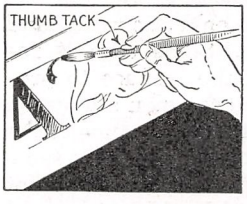
Swinging Danger Sign at Construction Job Warns Motorists



Swinging Sign at Street-Repair Job Attracts Motorists' Attention Quicker Than Stationary One

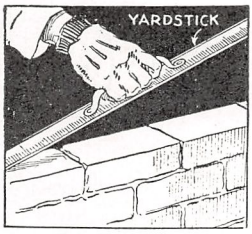
After having considerable trouble with motorists not noticing a warning sign set up in a street while repairing it, the contractor rigged up a swinging sign, which attracted attention quicker than a stationary one. The sign was pivoted to the top of a post by means of a bicycle pedal as shown. A concrete weight on the lower end of the sign kept it moving for several minutes once it was started. Workmen passing near the sign gave it a swing to keep it in motion and the warning was kept moving practically all day.

Thumb Tack on Lettering Brush Helps Preserve Chisel Edge



To assure that his chisel-edged brush would be held correctly, one show-card writer put a thumb tack in the handle at the point where the tip of his index finger ordinarily rested. This served as a guide to hold the brush at the right angle without the necessity of looking at the edge each time the brush was picked up.—G. E. Hendrickson, Argyle, Wis.

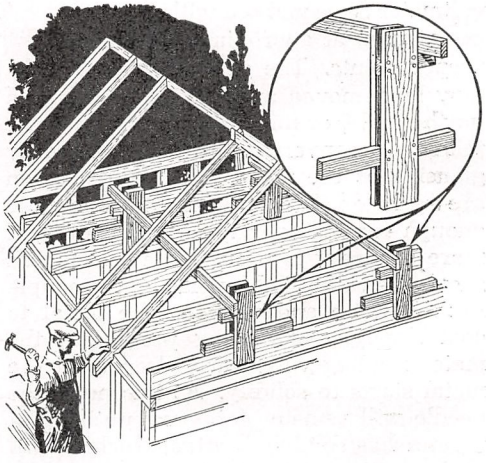
Handle Simplifies Use of Yardstick When Wearing Gloves



Bricklayers, masons and others who use a yardstick when wearing gloves, will find that a screen-door pull screwed to one side of the stick near the center makes it much easier to handle. This permits the stick to be picked up readily without removing the gloves.

Erecting Rafters Single-Handed with These Supports

Often the work of erecting rafters on small buildings can be done single-handed if you use a pair of supports on which the rafters may be rested while nailing the lower ends to the plate. Each support is merely a suitable length of 2 by 6-in.

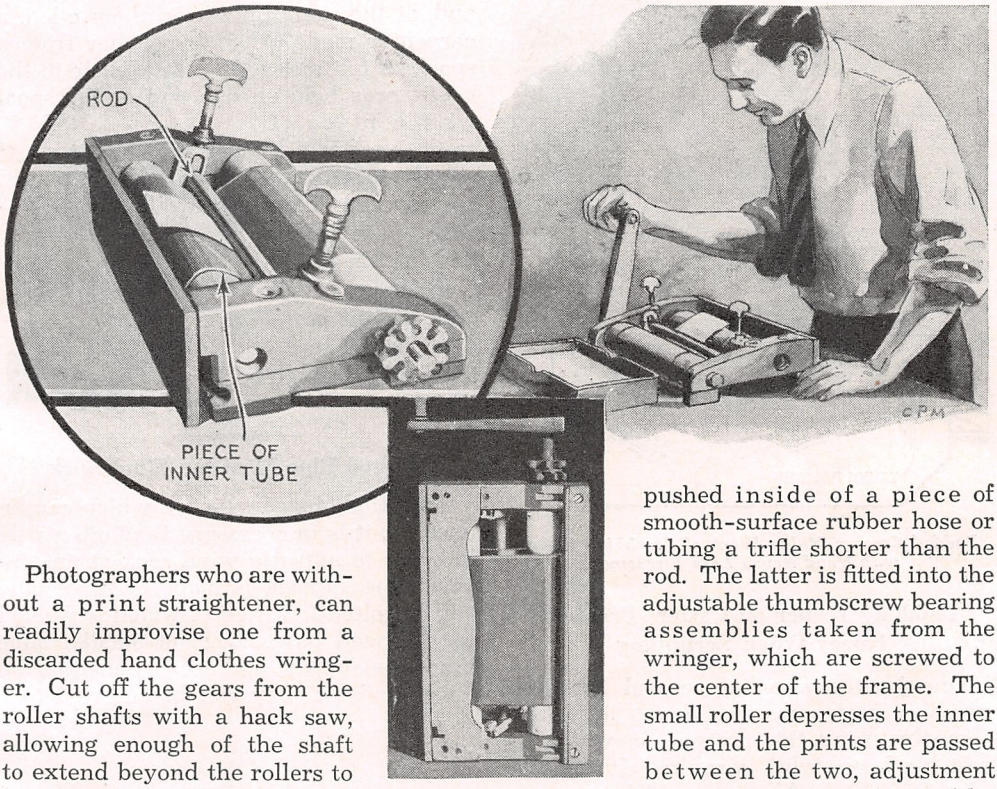


One Man Can Erect Rafters When Aided by These Wooden Supports

stock held at each end by a double leg which is slipped over the joist as shown.

¶To test the edge of tools, keep a piece of hardwood dowel rod handy in your kit.

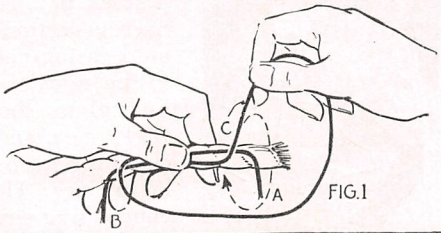
Photo-Print Straightener from Old Wringer

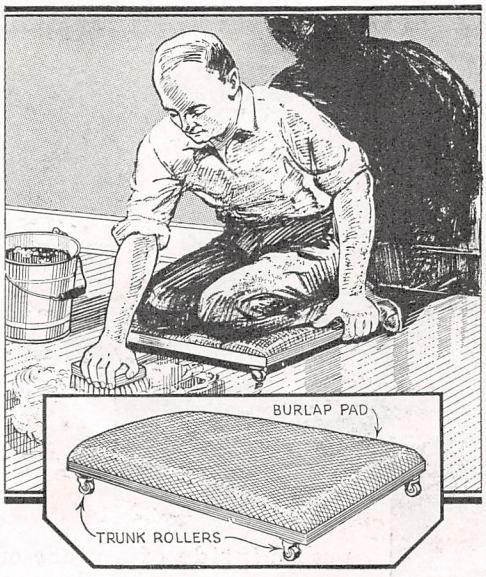


Photographers who are without a print straightener, can readily improvise one from a discarded hand clothes wringer. Cut off the gears from the roller shafts with a hack saw, allowing enough of the shaft to extend beyond the rollers to be slipped into a hardwood frame. Then cut a section of inner tube, slip it over the rollers and hold them apart until the tube is just taut. In this position, measure the distance between the centers of the shafts and add ¼ in., which gives you the correct spacing for the bearing holes to be drilled in the frame. A ½-in. brass rod, just as long as the rollers, is pushed inside of a piece of smooth-surface rubber hose or tubing a trifle shorter than the rod. The latter is fitted into the adjustable thumbscrew bearing assemblies taken from the wringer, which are screwed to the center of the frame. The small roller depresses the inner tube and the prints are passed between the two, adjustment for pressure being obtained by the thumbscrews. If desired, it may be driven by a small electric motor, but in this case, it will be necessary to leave a gear on one of the rollers to be used as a pulley to take a belt. Space between the teeth should be filled with solder and the surface turned down so that the pulley will be perfectly round.

Whipping Rope Ends to Prevent Them from Unraveling

Every person handling rope should know this simple method of whipping the ends with cord to prevent unraveling. Start in the position shown in Fig. 1, with the ends A and B hanging free. Grip the cord at C and wrap it around the end of the rope, wrapping toward the left hand. After the wrapping has been completed, run the end B through the loop D, Fig. 2, and pull both the end and loop underneath the wrapping tightly. Now cut off the loose ends and you will have a neat job as shown in Fig. 3.—I. W. Dickerson, Charles City, Ia.





Padded Creeper Makes Work of Scrubbing Floors with Hand Brush Less Tiresome

Padded Creeper on Casters Protects Knees When Scrubbing

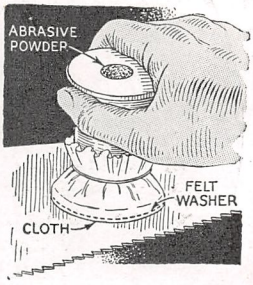
One janitor who has several floors to scrub each day makes his job less tiresome by using this creeper on which to rest his knees while working. It consists of a 1-in. wood block to which are fastened four trunk rollers and a burlap-covered pad as indicated. Trunk rollers or casters permit the creeper to be pushed in any direction.—Laurence M. Phillips, Pontiac, Mich.

Sections of Auto Tire Hold Lid on Feed Barrel

When feed is kept in a barrel in a stock pen, four narrow sections of auto casing nailed to the sides of the barrel as shown will serve as clamps to keep the lid in place. These clamps are strong enough to prevent cattle from pushing the lid off, yet they are flexible enough for a man to remove it easily.

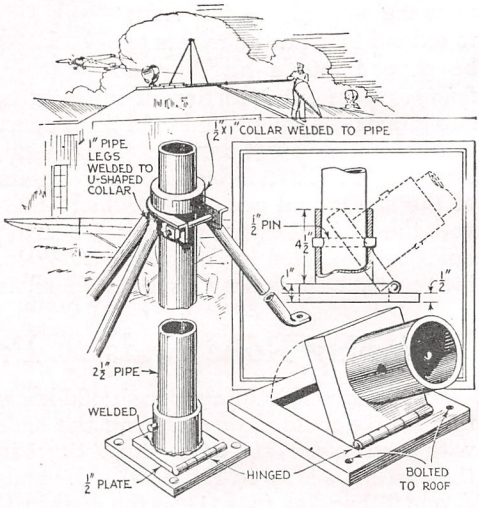
Tool Polisher Made from Spool

To remove rust and stains from his tools, and, at the same time keep them oiled, a carpenter made a handy polisher from a spool. A felt disk with a small hole in the center was held on one end of the spool with a piece of cloth, after which the hole in the spool was filled with fine abrasive powder. In use, a few drops of oil added to the powder keeps it feeding slowly through the cloth.



Hinged Pipe Mast for Wind Sock

With this hinged support, which can be owered, it is unnecessary to climb a pole in order to adjust a wind sock at an airport. The support is made of large pipe and is bolted to a sleeve, which is welded to a hinged base. Legs of smaller pipe brace the support and are flattened at the lower ends so they can be screwed to a hangar roof. The upper ends of the braces are welded to a U-shaped piece of angle iron, which straddles the pipe. A bolt through the ends of the angle iron is used to hold the mast upright.



Wind-Sock Mast Attached to Hinged Base Is Lowered Easily for Adjusting the Sock

Doing it Safely!

By
W. Clyde Lammey

YOU can easily acquire the habit of handling tools carefully, not only for the good of the tool itself but for your own safety as well. This applies equally to both hand tools and power equipment. A chisel or an ordinary pocketknife might be the cause of an accident if it is allowed to slip or otherwise get out of control, due to carelessness or a moment of inattention. Manufacturers of power-driven equipment for the home workshop have provided various safety devices and to get the maximum protection from these accessories one must keep the machine in the proper condition and use it with due care.

The circular saw is now used in practically all home workshops, and if the operator will observe consistently a few simple precautions it is fully as safe to use as a hand saw. As it is now made, the machine has been so perfected that it is practically foolproof mechanically. It is only necessary to see that the blade is properly set and sharpened at all times. This means that the teeth of the blade must have a uniform degree of set and must be kept sharp if the saw is to do its best work. Joint the blade each time you file and set it, to insure correct balance. If the blade is out of balance it is unsafe. When setting up or moving the saw be careful to place the machine in such a position in the shop that you have adequate light directly on the table, and remove anything above or near the machine that

Upper Left, Upper Guide of Band Saw Is Adjusted to Just Clear the Work; Upper Right, Using a Push Stick When Ripping Off Narrow Strips

Above, It Pays to Protect Your Eyes from Small Flying Bits of Metal When Using a Lathe or Grinder; Right, Keep the Circular-Saw Table Clear and Hold the Work on Each Side of the Blade

might possibly be dislodged and fall on the blade while the machine is running. Lack of caution in this one respect has been the direct cause of serious accidents.

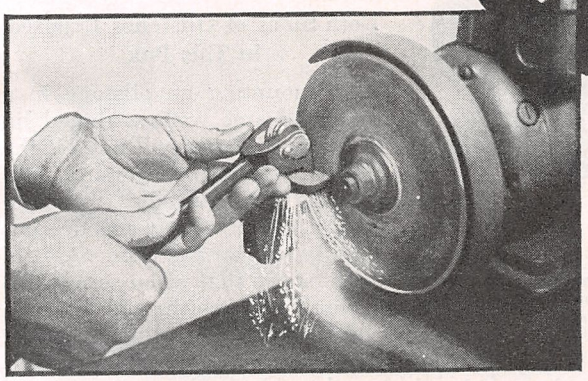
The careful operator of a circular saw acquires by practice the habit of knowing instinctively at all times just where his hands are and what they are doing. He keeps his attention concentrated on the machine all the time it is running and he allows nothing to distract this attention even for a moment. He is also very particular about a dangling shirt sleeve or necktie which might get caught in the blade. When ripping long narrow stock he first makes sure that the fence is securely fastened with the means provided, and if the stock is too long to handle easily, he runs the cut half way through, stops the machine, turns the material end for end and finishes the cut. When ripping certain kinds of stock, the careful operator is always on the alert for splinters that may possibly be broken off by the passage of the blade through the wood. Should these loose splinters be caught by the teeth they might be thrown with dangerous force. It is also wise to keep all small pieces of waste cleared away from in front of the machine as these may be the cause of a misstep while bending over the saw. When squaring the ends of a number of small pieces, measure the length required so that you can cut off at least ½ in. of waste at the ends. Then there is no danger of the waste material breaking up in small pieces as it is being cut off. Do not allow these small blocks to accumulate on the table at the rear of the blade. Stop the machine and clear them away.

Another and very important precaution is the use of a push stick when ripping narrow stock on the saw table or handling thin narrow stock over the jointer. A suitable push stick is simple to make and reduces the hazard to a minimum. Use the push stick when jointing thin stock or short pieces on the jointer. The dado head should always run under a suitable table insert, which is usually provided with the saw. In this way only that portion of the head which does the cutting is exposed. And, never under any circumstances attempt to cut a groove with the dado head "freehand," that is, without the guides. This can be done with

the saw blade with a reasonable degree of safety, provided you use a blade with a wide set, but it is never advisable and the larger the piece of stock the greater the accident hazard. There are a number of other special operations with the circular saw and its accessories, such as the molding-cutter attachment, which may be done with the same degree of safety as the operations that are more common.

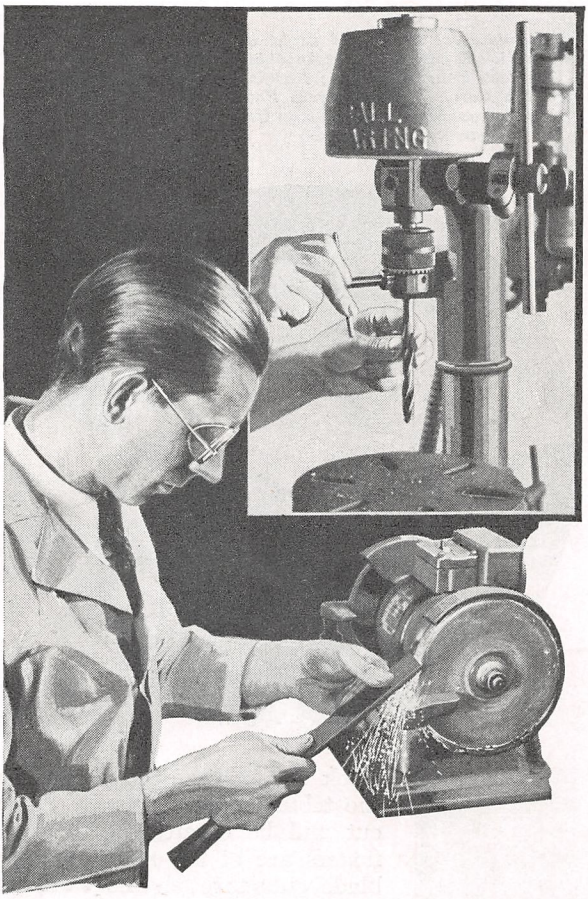
As made at the present time, band saws and the power scroll saws are in many ways more safe to use than hand tools because of the higher cutting speeds and smoothness of operation. Band saws in particular are so made that the blade is guarded at every point where it is likely to cause injury, and the mechanical construction of present-day power jig saws is such that it is practically impossible for the blade to cause any serious injury. However, it should be remembered that no matter how well a machine may be built, or how completely it may be guarded, carelessness on the part of the operator always creates an accident hazard. There are only two principal causes of trouble with the band saw; the first is running the machine with the guides and wheels improperly alined and the second is the failure to make sure that the stock has a firm bearing on the table. Make sure that the table is clear of all small blocks of waste from previous work, see that the stock to be cut rests securely on the table at the beginning of the cut and be careful where your fingers are at the moment the blade cuts through the work at the finish. Keep the upper guide as low as possible, adjust it so that the lower side just clears the work. Be sure that the table clamps on the trunnions are tight, to prevent the table from tipping unexpectedly and throwing the work out of line with the blade. If you must remove small pieces of waste from under the guides by hand either stop the machine or use a short stick. What applies to the band saw by way of precaution also is true of the power scroll saw, as the cutting action is essentially the same.

Always Have Plenty of Light on Your Work and Don't Let Anything Distract Your Attention; Rushing a Job Carelessly Results in Poor Workmanship and Involves an Unnecessary Hazard



When Dressing Emery Wheels, Stand to One Side and Not Directly in Front of the Wheel

When you use your metal-turning lathe on straight work where the tool is taking off a fairly heavy cut, keep your hands away from the curling chip. The edges are often razor-sharp and unless one is very careful, these chips may cause painful injury. If you do not wear glasses it is advisable to wear a pair of industrial goggles when you are working with either a wood



Above, Be sure to Remove the Wrench from the Drill Chuck before Starting the Machine; Below, When Grinding Edge Tools See That the Blade Bears Firmly against the Tool Rest

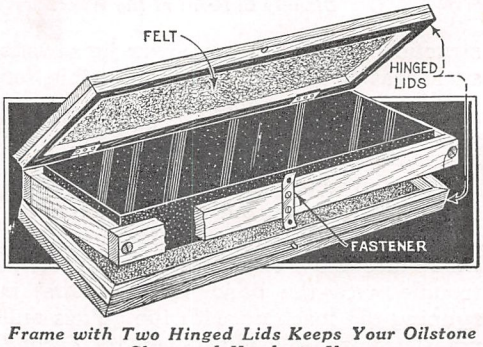
or metal-turning lathe and also when grinding tools or other work on an electric grinder. It is well to be careful about unbuttoned sleeves and to fasten securely any loose part of the clothing so that it cannot possibly catch in the revolving work or any moving part of either the metal or wood-turning lathe.

When two or more persons are operating the machines in the shop there should be some understanding between them so that one does not distract the attention of the other. This is a most frequent source of accidents. Obviously the machinery cannot be at fault. Many operators acquire the faculty of anticipating any possible trouble they may be likely to have with a special piece of work. Suppose for example you wish to drill a hole of medium size through an irregularly shaped piece of work on the drill press. Without thinking, many will grasp a small piece of work of this kind in one hand and attempt to hold it securely while the drill passes through. If the drill bit should bite suddenly the work is almost certain to revolve with the bit, and the sudden movement would be equally as certain to injure the hand, especially if there were any sharp projections. Small metal parts to be drilled on the power press should always be held in a vise, or lacking this, a suitable C-clamp.

One can easily learn how to use the various home workshop machines in the proper way, but one must be ever on guard against a moment of inattention, a lack of precaution.

Both Sides of Oilstones Exposed in This Box

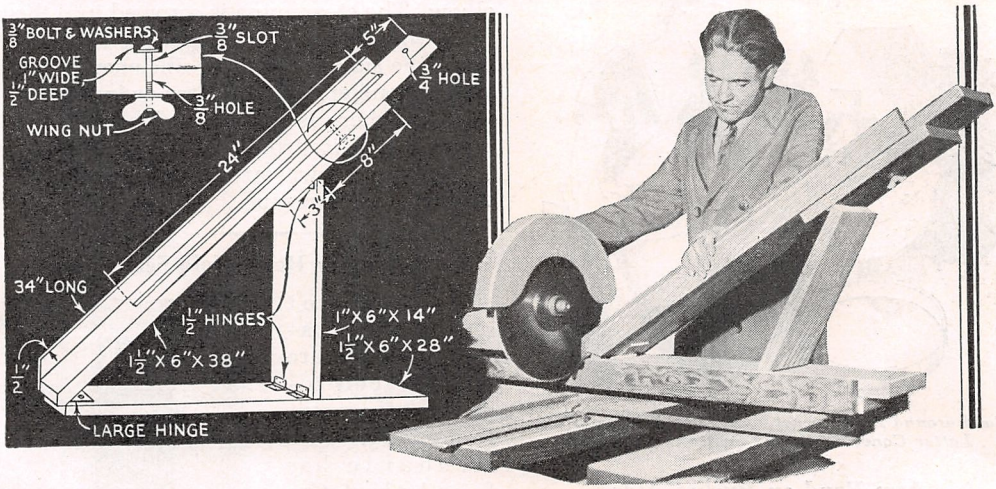
By mounting an oilstone in a wooden frame with a hinged lid on each side, you will not get the stone dirty when reversing it to use the opposite side. The two end pieces of the frame are cut slightly shorter than the width of the stone so that when screws are driven into them through the side pieces, the stone is held rigidly. Pieces of felt glued to the inside of the lids absorb the oil and keep the stone moist.



Frame with Two Hinged Lids Keeps Your Oilstone Clean and Handy to Use

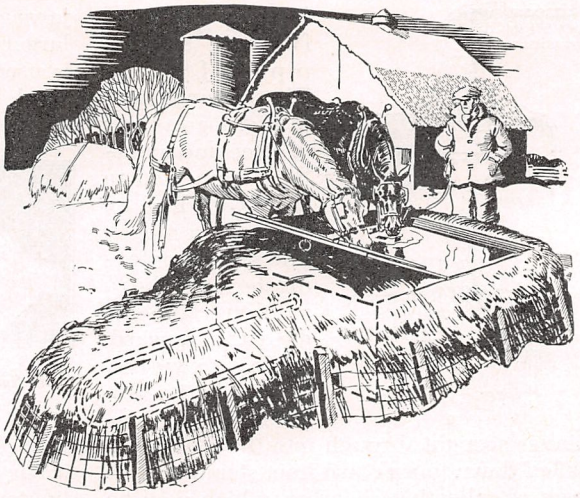
Sifted whiting dusted over cloth buffing wheels makes an excellent powder for polishing metal.

Guide for Cutting Angles on Stationary Saw



If you have a circular saw not equipped with a tilting table, angle cuts from 25 to 65° can be made by using this adjustable guide, which is a hinged assembly consisting of a base, work rest and a support for the latter. Notice the bolt and wing nut under the work rest to hold it at any desired angle, adjustment of the angle being obtained by moving the bolt up or down in a 24-in. slot in the rest. The support is hinged to the base and to a block, which carries the bolt as indicated. When a number of pieces are to be cut, a stop may be clamped to the work rest after the pieces have been cut off at one end. By doing this, the pieces are cut uniformly without measuring them. Material up to 6 or 8 ft. long can be cut on the guide conveniently by one man, but for longer stock, it is best to have a helper.

Fermenting Straw Keeps Water in Tank from Freezing



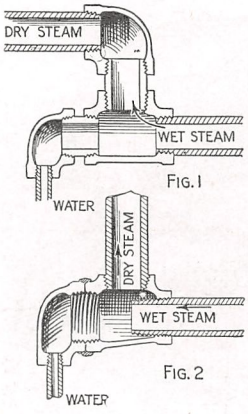
Used successfully on a live stock farm in Minnesota, this self-operating water-tank heater utilizes heat produced by fermentation of a mixture of straw and horse manure. A 17 or 18-ft. length of 1½-in. pipe is bent to a U-shape about 1 ft. wide, depending on the height of the water level maintained in the tank, and is installed in one side of the tank as indicated by dotted lines in the drawing. For efficient operation, it is necessary that the water level in the tank be kept above the upper end of the pipe at all times. After installing the pipe, cover it 2 or 3 ft. deep with the straw-and-manure mixture, extending the latter around the sides of the tank as indicated. Also put a wood cover over the tank and cover it with the mixture, leaving a drinking hole at one end. A hinged lid, preferably one that is insulated to keep out cold air, should be put over the hole.

Band around Feed Bucket, with Loop for Arm, Holds Latter Conveniently for Scattering Contents

Arm Band on Bucket Aids When Feeding Chickens

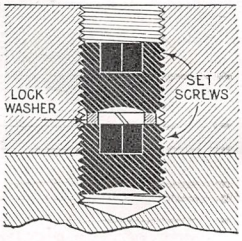
When a bucket is carried in one hand while feeding chickens or sowing seed, an iron band around the bucket, under the rim, as shown, will make it less tiresome to carry. The band has a loop formed on one side to take the arm. In use, the arm is pushed through the loop with the hand supporting the bottom of the bucket.

Water Trap for Steam or Air Lines



Here are two effective methods of freeing steam pipes of water. The arrangement in Fig. 1 consists of a tee and an elbow connected to the steam line by means of a nipple. The steam entering the tee makes a sudden right-angle turn upward, while the water, carried by its own momentum, continues straight through into the elbow and is led down to a return line, steam trap or even a collecting chamber, which may be blown off occasionally. Fig. 2 shows a neater and more effective assembly using a reducing tee and having the outlet, opposite the end of the steam pipe, a size or two larger. To this is welded a reducing elbow. The steam pipe is screwed into the tee so that its end comes opposite the center of the side outlet. The efficiency of the latter arrangement is greater owing to the fact that there is nothing to obstruct the water before it strikes the back wall and is deflected downward to the drain, or through a return pipe.

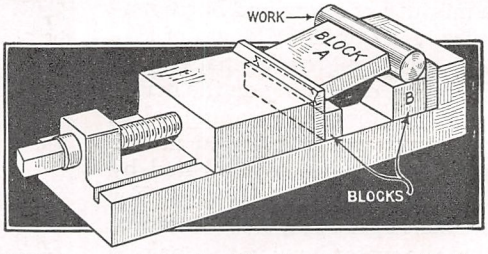
Lock Washer Helps Hold Set Screws



Hollow set screws used in various machines are often placed together to prevent loosening. One mechanic has found that the screws will hold better if a lock washer is inserted between them as indicated in the drawing.—Thomas Trail, Baltimore, Md.

Vise Setup Holds Work Rigidly in Milling Machine

Here is a vise setup for shaping or milling duplicate round work that has many advantages over the usual method of reseating the work with a hammer. Two steel blocks are placed between the vise jaws as shown and the work is laid on the larger one, B, after which a third block, A, is used as shown. When the vise is tightened, block A forces the work against



This Setup in a Milling Machine Eliminates Seating Work After Tightening It in a Vise

block B and prevents it from rising, which it has a tendency to do when the jaws are tightened with the ordinary setup.

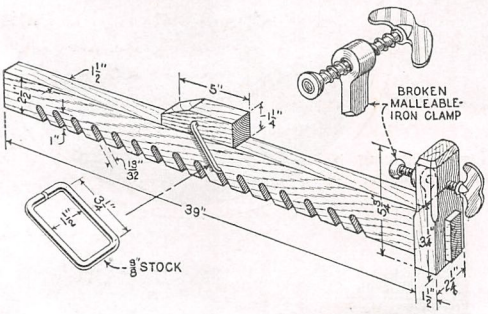
¶Oxalic acid dissolved in water is excellent for cleaning tarnished brass.

Fly Repellents for Live Stock

Experts at the Nebraska college of agriculture suggest the following mixtures to keep flies away from live stock. A solution of used crankcase oil, 1 gal., and oil of tar or cold-tar stock dip, 1 pt., sprayed on the animals has been found effective. Another good solution for the purpose consists of fish oil, 1 gal., oil of tar, ½ gal., and crude carbolic acid, 1 oz. A third solution consists of laundry soap, 3 bars, dissolved in cold-tar dip, 4½ qts., fish oil, 4½ qts., kerosene, 3 qts., whale oil, 2 qts., and oil of tar, 1½ qts. If applied lightly, these repellents will not injure the animals or discolor their hair.

Woodworkers' Bar Clamps Made from Scrap Parts

By using a screw from a broken C-clamp or one taken from an old washing-machine wringer, a bar clamp can be made at small cost. A hardwood bar has several oblique slots cut in the lower edge and a block, which carries the screw, is bolted to the front end. This block is slotted to straddle the bar as shown. Near the upper end, the

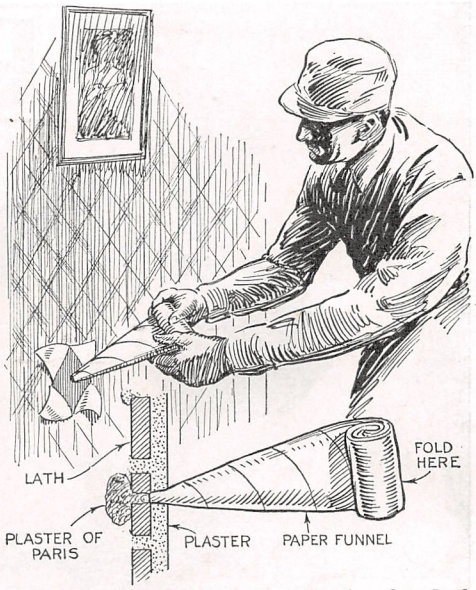


Woodworkers' Bar Clamp Made from Hardwood and Screw from Broken C-Clamp

block is drilled to take the screw and is mortised on the inside surface for the broken segment of the clamp, which should fit the mortise snugly. A sliding stop carries an iron-rod loop or ring, which works in the slots.

Loose Plaster Anchored without Nails or Screws

To securely anchor plaster that has loosened on a wall, one paperhanger uses plaster of paris, which he forces into place



Loose Plaster on Wall Securely Anchored to Lath with Plaster of Paris

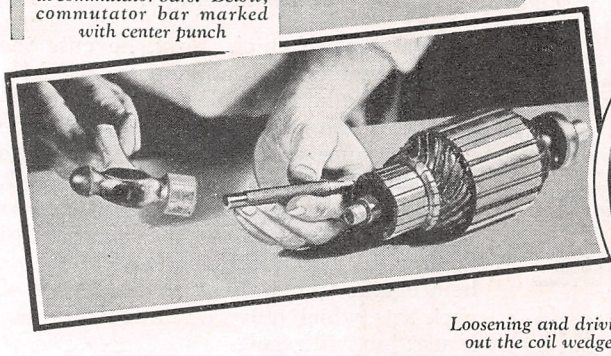
with a paper funnel. First, he cuts the wallpaper, folds it back, and drills a hole through the lath and plaster. Then, holding the loose plaster firmly against the lath, he squeezes the plaster of paris into the hole, taking care to get plenty of it behind the lath to form a good anchor. As the funnel is withdrawn, the hole is filled flush with the wall. If the loose plaster is held against the wall until the plaster of paris sets, which only takes a few minutes, a neat job will result.

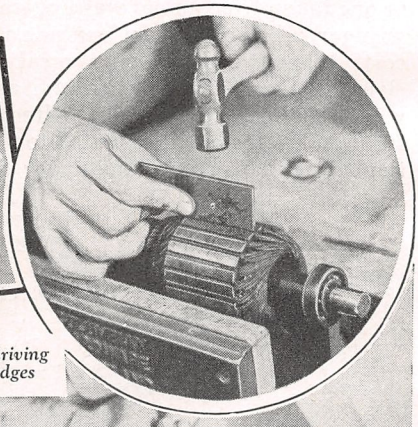
Humane Method of Transporting Fowls

When several live fowls are taken to market in a car it is common practice to tie their legs together and then lock their wings. A more humane method is to put each bird in a paper bag from which one corner of the bottom has been torn away to provide an opening for the head of the fowl. The top of the bag is tied about its legs as shown preventing the birds from flopping about.

REWINDING

Above, sawing out wire slots in commutator bars. Below, commutator bar marked with center punch



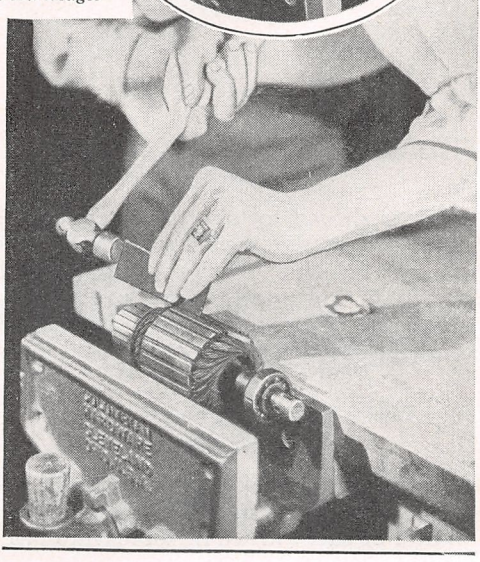


Loosening and driving out the coil wedges

By C. A. CROWLEY

ELECTRIC motors, either a.c. or d.c., whose windings have been burned out or damaged may be repaired or completely rewound by anyone with only such simple tools as are available in any shop. Before taking the motor apart the frame parts should be marked with a file to simplify reassembly. End plates of some motors will fit together in several positions but the armature may not turn freely unless the parts are replaced in their original positions. If the armature has already been stripped of its old winding, it is not possible for the amateur to work out the windings required, unless the necessary information as to the wire size, turns and connections can be procured from the manufacturer of the motor. Most motor repair shops will not take a motor for rewind if the old windings have been stripped unless the machine happens to be one of a type which they have previously rewound.

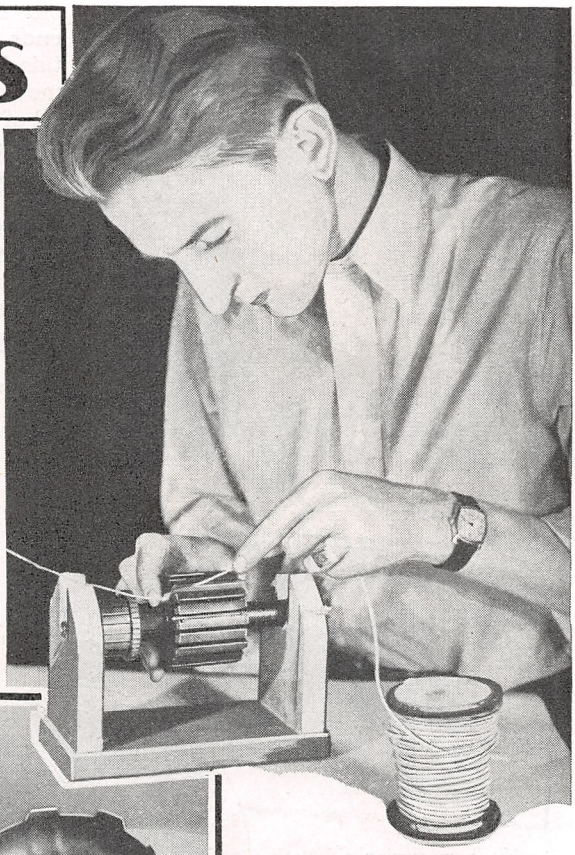
The first step in preparing a motor for rewinding is to loosen the wood or fiber strips that hold the coils in place. This is done by tapping a metal strip held over the wedges to drive them down against the wires. Next, the wedges are carefully driven out.



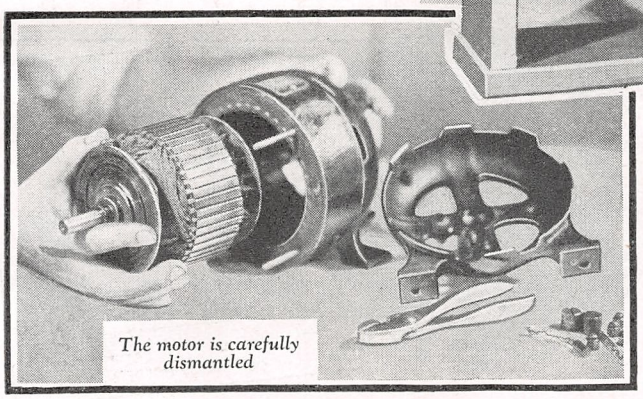
MOTORS

If care is taken the wedges can be saved for replacement. If they are damaged new ones will need to be cut to the same size from wood or sheet fiber.

As the old wire is removed, a simple system of marking and recording should be used so that the new windings may be made exactly like the old ones. The first step in recording the old windings is to find the last coil which was wound onto the armature. This will be the one which can be unwound without disturbing other coils. The two ends of this coil are soldered to two of the copper commutator bars. One of the ends



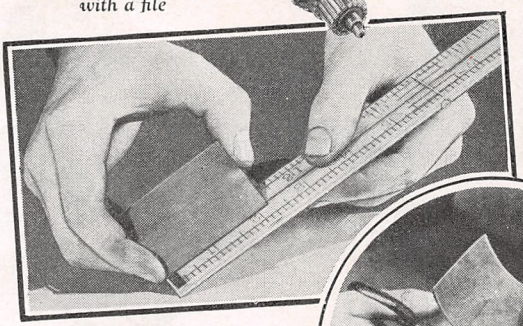
Stand for holding the armature makes rewinding easier



The motor is carefully dismantled

is located and the bar to which it is connected is marked with a center punch to indicate that it is segment No. 1. This same coil end is then cut from the segment and lifted from the first slot through which it passes. The metal on each side of this slot is then marked with an X to indicate that the slot between the marks is No. 1 slot. To make identification of the other slots and segments easy, the armature is held in front of you with the commutator closest. The marked bar is No. 1 and the next bar to it when your eye follows around in the same direction as the hands of a clock is bar No. 2, etc. The slots in the armature are given numbers in this same direction. The winding may be recorded as removed by drawing a diagram like the one shown as the work progresses. Although this gives adequate information after only one coil has been removed in the hands of an experienced winder, the table method of recording will be found simpler to follow by the beginner. An example of such a table is shown. To illustrate the use of the table method of recording we will go through the process of taking data on an armature which has 16 slots and 16 segments in the armature. After locating the last coil placed on the armature, we mark one of the commutator bars to which it is connected and cut the end of the coil from this bar and lift it from the slot. This slot is marked No. 1 as explained above. This information is re-

Armature slot is marked with a file



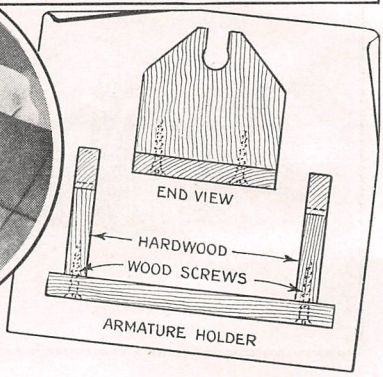
Above, measuring old slot insulation to get pattern for new insulation which is cut from wood or sheet fiber

corded in the first line of the table. We next unwind this same wire from the next slot through which it passes. We find this to be No. 9 slot and record it as shown. We can now proceed to unwind the coil completely while counting the turns. In this case there were ten turns in the coil as indicated in the table. Pulling the wire free, we find that the other end of the coil is connected to bar No. 2. We can now remove the wire completely; however, it should be placed in a box so that all of the wire removed from the armature may be weighed in order to determine how much wire will be required for rewinding. The next coil removed and recorded by the same method should be the one which is left free for removal without disturbing the remaining coils. In our illustration this coil has one of its ends connected to bar No. 2. After noting this in the table we cut it loose and remove the coil exactly as before, recording all of the data in the table. The remaining coils are removed and recorded in exactly the same manner. When all of the coils have been removed we weigh the wire and add about 10 per cent to find the weight of the wire needed to do the job. The size of the wire is next determined with a wire gauge.

Recording an Armature Winding

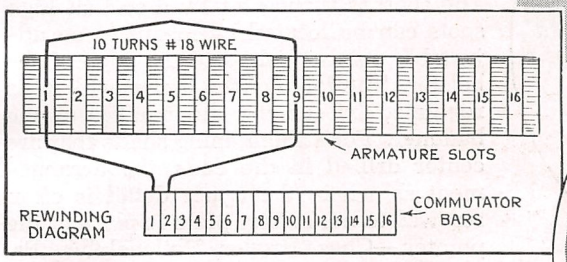
Size of Wire Used—No. 18. Weight of Wire—2¾ Lbs.

From Bar	To Slot	To Slot	To Bar	Turns
1	1	9	2	10
2	2	10	3	10
3	3	11	4	10
4	4	12	5	10
5	5	13	6	10
6	6	14	7	10
7	7	15	8	10
8	8	16	9	10
9	9	1	10	10
10	10	2	11	10
11	11	3	12	10
12	12	4	13	10
13	13	5	14	10
14	14	6	15	10
15	15	7	16	10
16	16	8	1	10



Armatures are wound and connected by so many methods that it is impossible to make a general rule for winding and connecting the coils; therefore the exact connections as found on the armature, regardless of the number of slots and segments, should be followed carefully when removing the old winding and placing the new one on the core. In some armatures you will find that there are dead coils that are not connected to commutator bars. When this condition is found it should be duplicated in the rewinding. Also, you may find that some of the commutator bars are not connected to coils but simply connected to

other bars. When this condition is found it should be noted so that the same connections can be made when rewinding. If the commutator is removed it must be replaced so that bar No. 1 is over the same point on the shaft as it was originally. Some rotors, as the rotating member of an induction motor is called, are wound with only two coils of wire. The ends of these coils are connected to brass or bronze disks upon which brushes rub when the motor is in operation. When taking data for rewinding this type of motor, the slots should be numbered starting at any convenient point and the wire removed carefully, noting not only the slot from which it was removed and the number of turns but also the direction in which the coil was wound so that new wires can be wound on in exactly the same manner.



Above, old wire weighed to find amount required. Below, wrapping tape between commutator and iron core

When working on a motor of this type it would be well to work out a simple table to meet your special requirements before removing any of the wire. The size of the wire for the two coils will be different so it will be necessary to use two sizes of wire for rewinding.

With the old wire removed, the insulation from the slots should be removed and one piece of it measured, so that new insulation can be cut to slightly larger dimensions from fiber with a photo trimmer. The old wires and solder are next sawed out of the wire slots in the commutator bars. A convenient tool for this job is made by mounting a length of hack-saw blade in a piece of dowel rod. The space between the commutator and the iron core is then partly filled with plain cotton tape, which will serve to prevent the ends of the coils from being pressed against the metal shaft. Shellac may be used to hold the cotton tape in place. A winding frame of suitable dimensions to hold the armature is then built from wood. With the armature mounted in the rack, the winding is started by winding on the last coil that was removed, or the coil recorded at the bottom of the record table. The ends of the coil should be left long and marked for the bar to which they are to be connected so that all of them may be soldered to the proper bars after the entire rewinding job has been completed. Any convenient plan of marking the leads may be used. While winding, the coils should be neatly formed and the wires pressed tightly into the slots, always being careful to avoid damaging the insulation. The ends of the coils should be neatly formed so that there will be

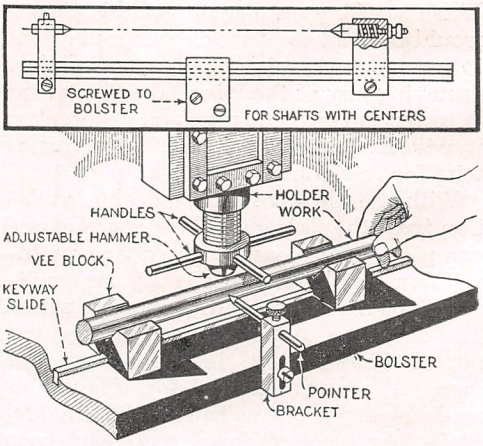
Upper, gauging the wire thickness. Lower, coil leads carefully soldered to commutator bars

plenty of room for the entire winding. The wire used should have the same kind of insulation as was originally used on the machine to insure plenty of room. When the winding has been completed, the leads are pressed into the bar slots and soldered securely, after which the surplus solder may be removed with a file. The windings are then bound down tightly as they were before and given a coat of varnish. If a can of varnish large enough for the job is available the best plan is to dip the armature and allow it to soak up as much varnish as it will. After a thorough drying, the armature is ready for installation in the motor.

Induction motors frequently have a rotor without windings but have two windings on the frame or stator. These machines are very easy to rewind by simply removing the old winding and recording the slots, turns, wire sizes, direction of windings and connections. A suitable table for recording these values may be made by anyone. If an induction motor hums when connected to the line but will not start until given a brisk spin you will know that the starting winding, or the winding of small wire only, has burned out. In this case only this winding has to be replaced.

Straightening Short Shafts in a Punch Press

A method of rapidly straightening small, short shafts in a punch press is shown in the illustration. A holder is put in the ram of the press and is threaded to fit the adjustable hammer. Two V-blocks, with keys fitted to the bottom, slide in a keyway in the bolster plate and support the shaft to be straightened. The shaft is turned by hand so that high spots can be located by means of an adjustable pointer bolted to the edge of the bolster. The force of the hammer blows is regulated by turning the handles of the hammer. For straightening shafts that are center drilled in the ends, the arrangement shown in the upper detail is often screwed to the bolster plate in place of the pointer.—Chas. Kugler, Philadelphia, Pa.



Simple Set-Up for Straightening Short Rods and Shafts in a Punch Press

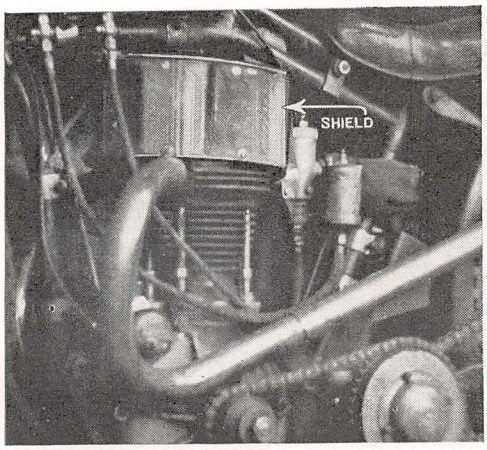
¶Denatured alcohol added to India ink in the proportion of ink, 1 fluid oz., to alcohol, 10 drops, will cause the ink to dry rapidly and add brilliancy to the work.

Making a Smooth Cut in Metal with Oxyacetylene Torch

When metal is cut with an oxyacetylene torch, the edges are generally left rough. To make a smooth cut, proceed as follows: Heat the part to be cut with a rich flame until the metal begins to burn. Then, while still applying the torch, turn off the acetylene gas and use straight oxygen, which will make a clean cut as long as the preheated metal retains enough heat. When the metal starts to cool, repeat the procedure.—C. E. Walton, Lewisburg, Pa.

Shield Protects Rocker-Arm Bearings on Motorcycle

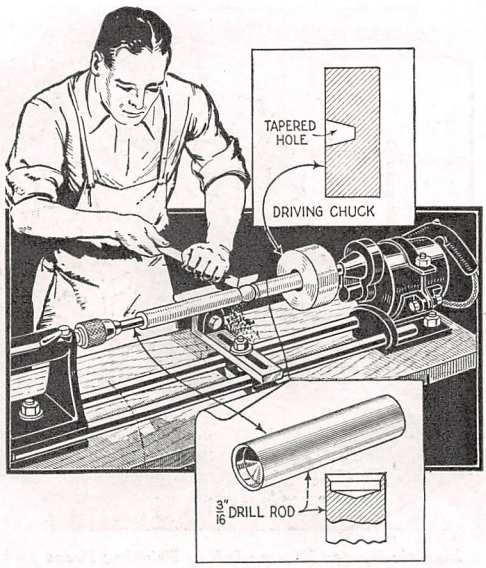
To keep dirt out of the rocker-arm assembly of motorcycles, some racing drivers use a shield like the one shown. A framework of light metal is constructed to fit over the cylinder head and is covered with fine copper mesh. The shield is applicable to any motorcycle using overhead valves and will greatly increase the life of the rocker-arm bearings.—James Hennessy, Alameda, Calif.



Fine Wire-Mesh Shield Keeps Dirt Out of Rocker-Arm Assembly on Motorcycle

Birch Trees Serve as Danger Signs at Road Intersection

Silver birch trees are being planted at the corners of crossroads near Oxford, England, so that their white trunks will reflect light from car headlamps and thus serve as a warning to the motorist that he is approaching a crossroad.



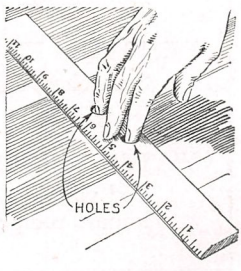
Chuck and Tailstock Center for Turning Small Work in Wood-Turning Lathe

Wood Lathe Adapted to Turning Work of Small Diameters

With the homemade chuck and tailstock center shown, you can easily turn work of small diameter. The chuck is a small disk of hardwood, screwed to the faceplate, with a tapered hole bored in it as shown. A 1-in. length of drill rod is then drilled at one end to a depth of 1/16 in. with a drill bit 1/16 in. smaller than the diameter of the rod. Then the projecting lip is reamed with a bit larger than the diameter of the rod. This leaves a sharp edge, which engages the work while the friction grip of the headstock chuck drives it.

Finger Holes Make Draftsmen's Rule Easy to Manipulate

Draftsmen will find that they can move their rules about easily on drawings if a couple of holes are drilled part way through one side of each, at the center as shown. The holes should be about 2 in. apart and just large enough to take the tips of the first and third fingers.



Electric Heater Warms Ink in Printing Press and Prevents Paper Sticking to Type

Keeping Press Ink Warm in Winter

Owners of small newspaper offices and job-printing shops equipped with flat-bed presses who use the same grade of ink the year around, will find that trouble experienced in cold weather by having the paper stick to the type can be eliminated by keeping the ink warm. Fasten an electric heater to the frame of the press just above the ink fountain and direct its heat rays toward the center of the fountain.

Installing Crankcase Gaskets

When replacing the crankcase on a car, first soak the gasket, if cork, in water. Then put it in place and tie it fast on each side with a fine cord. This will hold the gasket until the crankcase can be bolted in place. The cords need not be removed as they will not bother.

The Next Issue

SAFE, FRONT-STEERING ICE BOAT DOES NOT SPILL

Small, easily handled ice boat that anyone can make. Skids or buffers on the outside end of the cross beam that carries the two rear runners, prevent spilling. A tiller at the rear controls the single steering runner at the front.

HOW YOU CAN MAKE VENETIAN BLINDS

More popular today than ever! This article goes into details of construction and shows how you can make these attractive window blinds at little cost.

TRICKS OF USING WOOD CHISELS

You can soon become adept at handling wood chisels and gouges by carefully reading information by an expert who describes the technique of using them.

METAL SPINNING ON THE LATHE

Artistic bowls, trays and other objects spun from pewter, copper or aluminum mounted on wood forms held by the faceplate of your woodworking lathe.

REMOVING FURNITURE SCARS

Scratches, dents and scars that mar the appearance of your valuable pieces of furniture can be removed, filled and made less conspicuous by simple methods.

WATCH-DRIVEN TOYS

Old watches with the escapement removed are fitted with a small crank to impart reciprocating movement to animate several toys made of balsa wood.

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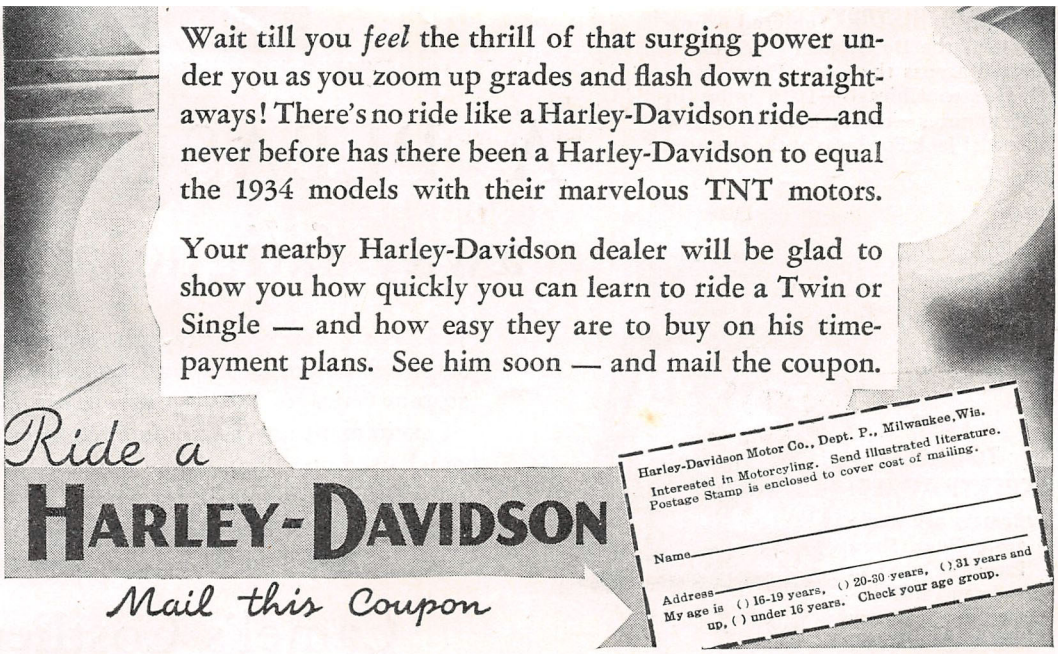

Wait till you *feel* the thrill of that surging power under you as you zoom up grades and flash down straightaways! There's no ride like a Harley-Davidson ride—and never before has there been a Harley-Davidson to equal the 1934 models with their marvelous TNT motors.
Your nearby Harley-Davidson dealer will be glad to show you how quickly you can learn to ride a Twin or Single — and how easy they are to buy on his time-payment plans. See him soon — and mail the coupon.
Ride a
HARLEY-DAVIDSON
Mail this Coupon
Harley-Davidson Motor Co., Dept. P., Milwaukee, Wis.
Interested in Motorcycling. Send illustrated literature.
Postage Stamp is enclosed to cover cost of mailing.
Name
Address
My age is ( ) 16-19 years, ( ) 20-30 years, ( ) 31 years and up, ( ) under 16 years. Check your age group.

[ad cutout]

RAILROAD HISTORY entered a new phase as the Burlington's "Zephyr" flashed across the Great Plains from Denver to Chicago—1015 miles in 785 minutes—to set a flock of new records! Jack Ford was at the throttle.

Copyright, 1934, R. J. Reynolds Tobacco Company

A PLEASURE

away fatigue and

Jack Ford, crack Burlington engineer, says: "When the 'Zephyr' rolled to a stop at Chicago, I'd been through a lot of excitement and strain and felt pretty much used up. But a Camel quickly gave me a 'lift' and I felt O. K.

"Most railroad engineers prefer Camels. And Camels help to increase

Camel's Costlier

LEAF-TOBACCO EXPERTS AGREE:

"Camels are made from finer, More Expensive Tobaccos —Turkish and Domestic — than any other popular brand."

that drives listlessness!

their energy when they feel worn out. I've smoked a lot of Camels in my time, and that goes for me—all the way."

The findings of a famous scientific laboratory have confirmed Camel's "energizing effect." So begin today to enjoy Camels *often!* The costlier tobaccos in Camels never affect the nerves.

SECRETARY. Says Elizabeth Harben: "I smoke a great deal, but I am careful in my choice of cigarettes. I prefer Camels. They don't make my nerves jumpy."

SPORTSWOMAN PILOT. Mrs. Cecil Kenyon says: "Camels are the mildest cigarette I know. Morning, noon, and night I can smoke them steadily—without a touch of upset nerves."

Tobaccos never get on your Nerves!

TAKE *Dozens* OF SNAPSHOTS AT NIGHT

IT'S EASY. Snapshots at night are now as easy to take as snapshots in the sunlight . . . *thanks to super speed film and G-E MAZDA Photoflood lamps.* And they're inexpensive, too . . . for G-E MAZDA Photoflood lamps are good for two hours of picture-taking . . . good for dozens of pictures.

All you need is a camera with a fast F/6.3 lens* (use wide open), some super speed film, and a few G-E MAZDA Photoflood lamps in your light sockets. Then you are ready to snap pictures of your family, friends, parties or workshop products . . . indoors AT NIGHT!

Your druggist or camera dealer can supply you with film and lamps. General Electric Company, Nela Park, Cleveland, Ohio.

* *Box cameras and folding cameras with slow lenses can get good pictures with time exposures of one or two seconds.*

FOR ACTION PICTURES

and shots of babies and pets, use G-E MAZDA Photo*flash* lamps. They operate simply, in light socket or from flashlight batteries. Enable even box cameras to get lively night shots. Each lamp gets one picture. Retails for 15c.

GENERAL ELECTRIC MAZDA PHOTO LAMPS

NEW TRICKS OF WEATHER FORECASTING

(Continued from page 708)

of air from the tropics and cold dry blocks from the frigid zones meet in the temperate latitudes and are then boosted eastward by the earth's rotation. Instead of equalizing each other the air masses tend to preserve their original characteristics, and where two of the masses join the differences in temperature and moisture content create unstable weather. It has been found that the warm masses from the tropics tend to rise above and flow over the denser cold masses, the result being cloudiness, squally weather and rain.

Eventually, when sufficient data have been compiled, a new technique in forecasting may result because weather experts know that some of the weather on the surface is first manufactured in the upper portions of the air masses. Another problem the forecasters would like to solve is why the air masses move toward each other apparently without rhyme or reason. If the causes of this could be found it might mark a great step toward predicting general weather conditions a week or so in advance.

However, weather officials know that no matter how accurate a general prediction covering a wide area may be, the weather at any particular point is influenced by local topography. That is the reason why the forecasting system is being decentralized. Local forecasts that take local conditions into account will be more accurate than predictions of general weather trends.

As an example, this "local knowledge" has increased the safety of air transportation at a western airport where pilots could never be sure when a dense fog might blanket the field. Recently the local weather bureau discovered that when the wind shifts to a certain quarter at one of its mountain observation stations, fog always settles in the vicinity of the airport a few hours later. Now the weather bureau can warn the airport dispatcher several hours ahead of time when a fog is due. Local studies like the above, it is hoped, will enable forecasters to anticipate fogs in other districts.

The use of an international code provides ten times more data on weather than were previously reported. Weather offi-

(Continued to page 134A)

Take snapshots like this— AT NIGHT!

IT'S EASY TO MAKE THIS PICTURE

Use Kodak "SS" Film. Set your camera for 1/25 second — open lens diaphragm to *f*.6.3. Put 1 Mazda Photoflood bulb in lamp A— 2 in lamp B. Distances as indicated.

Sight the subject, click the shutter — and you've made the picture. Photoflood bulbs cost 25¢ each — last for many pictures.

. . . with Eastman's new high-speed "SS" Film

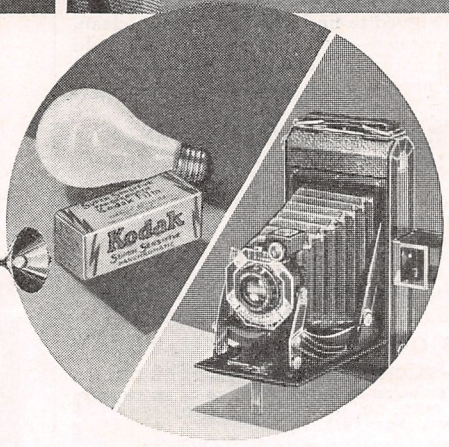
CAMERAS HAVE BEEN GIVEN new vision. You can take snapshots indoors . . . *at night!* What a wealth of new picture opportunities. The fireside scenes—the parties—the children at their indoor games.

Use a camera with an *f*.6.3 (or faster) lens, loaded with Kodak Super Sensitive Panchromatic Film. This high-speed (extra sensitive) "SS" Film does the trick—it's three times as fast as ordinary film under artificial light.

For light, use two or three Mazda Photoflood bulbs. Just hold the camera in your hands, set for 1/25 second, lens at *f*.6.3 opening, and click the shutter.

For indoor pictures at night with slower lens cameras (including box models) use Verichrome (or "SS") and a Photo*flash* bulb—see free folder—with camera set for "time" exposures.

FREE FOLDER . . . Complete instructions on indoor night photography. Photo*flood* snapshots . . . Photo*flash* pictures . . . all are covered in this free folder. At your Kodak dealer's—or write for your copy today. Eastman Kodak Co., Rochester, N. Y.



KODAFLECTOR—Inexpensive, efficient, sturdy, easy to use . . . makes 2 Photoflood bulbs do the work of 9. Complete, with folding stand, reflectors and cord, $5.

Kodak "SS"—the lightning-fast film with the green lightning flashes on the familiar yellow box—the film that, indoors or out, in any light, improves picture quality.

Kodak Six-20 with Kodak Anastigmat lens *f*.6.3 is ideal for night snapshots. Pictures 2¼ x 3¼ inches, price $17.50. Kodak Six-16, with *f*.6.3 lens, pictures 2½ x 4¼ inches, $20.

IF IT ISN'T AN EASTMAN, IT ISN'T A KODAK

When writing to advertisers please mention Popular Mechanics

This 48-Page Book and a Generous Sample

BOTH FREE!!

Every handyman, home-craftsman and manual-training student should have this interesting and helpful Gluing Guide. It contains dozens of money-making and money-saving ideas on building, repairing and mending things easily and *permanently*. It tells how you can glue everything to stay glued . . . in spite of moisture, heat, rough usage or plain neglect.

FREE SAMPLE CASCO Waterproof GLUE

AT NO COST, you will also receive enough CASCO to do several gluing jobs. This is the same super-strength, wonder-working adhesive used in big woodworking and furniture factories. You will be amazed and intrigued to find that CASCO—a clean, non-odorous powder—mixes so quickly in cold water, forming a creamy, easy-spreading glue that makes all jobs *permanent, heat-proof* and *moisture-proof*.

The Big Secret of CASCO'S Great Strength

Unlike ordinary glues and pastes, which harden merely by evaporation, *CASCO sets chemically like concrete.* You only have to glue it once with CASCO.

Your Hardware Dealer carries CASCO in 10c, 25c 40c and 65c cans. Also 5-lb. and 10-lb. sizes.

TEAR THIS OUT . . . . . MAIL TODAY

(Save 2c—stick it on a penny post card)

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Please send me my copy of the CASCO Gluing Guide together with your free trial sample.

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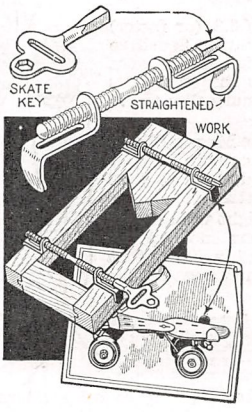
P. M. 11-34

A Few Hints on Gluing

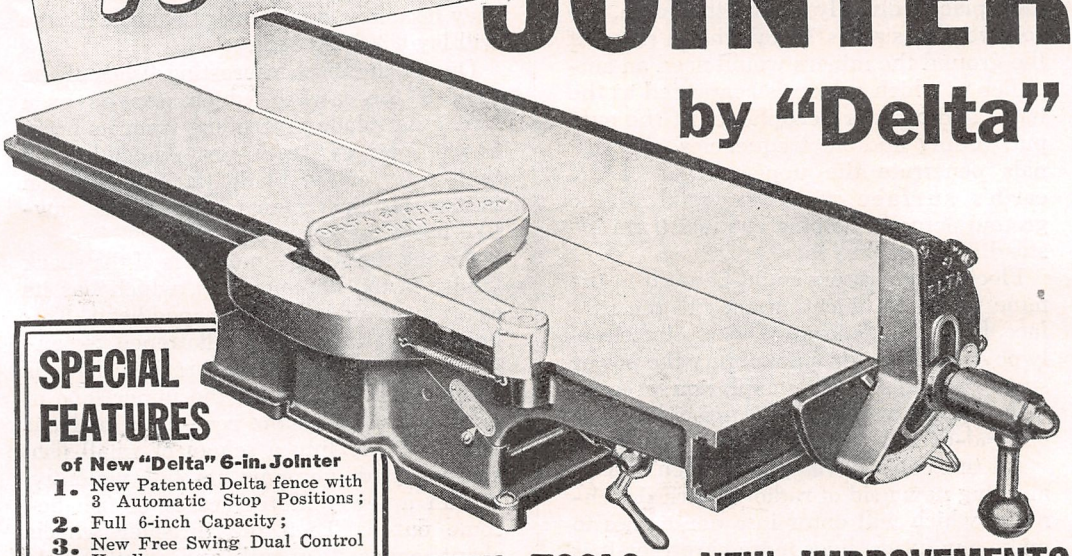
When gluing doweled or mortise-and-tenon joints, it is better to apply the glue inside of the mortises and dowel holes than to apply it to the dowels and tenons where it may be scraped off in assembling the work. A toothbrush is often handy for applying the glue. For small mortises, the bristles of the brush may be cut short, or the brush may be whittled down in width, to get into tight places. An ordinary comb is handy for applying glue to narrow grooves. In assembling panel work, be sure that there is plenty of space to permit the panels to shrink or swell a reasonable amount without striking the bottom of the grooves in which they fit. This precaution is unnecessary when plywood panels are used. The usual tedious job of applying glue to inlay grooves can be done easily by thinning it enough to be applied with an oil can, the spout of which has been cut off so that the opening is relatively large. Another job that often puzzles the layman is getting just the right amount of glue on an overlay. This can be done easily by covering a surfaced board with glue, pressing the overlay firmly into the tacky surface and then immediately removing it and placing it in position on the work. Just the right amount of glue will adhere to the underside of the overlay to make it stick in place properly without letting the glue squeeze out from under the edges when the panel is pressed into position.

Model-Makers' Screw Clamps Made from Discarded Skates

Toe clamps taken from discarded roller or ice skates are handy for holding small model parts to glue them. The slightly curved ends of the clamp jaws are straightened as indicated. For a wider span, the clamp jaws may be screwed on a piece of drill rod, which has been threaded to the center from each end and filed to take the skate key.



New 6-INCH JOINTER by "Delta"



SPECIAL FEATURES

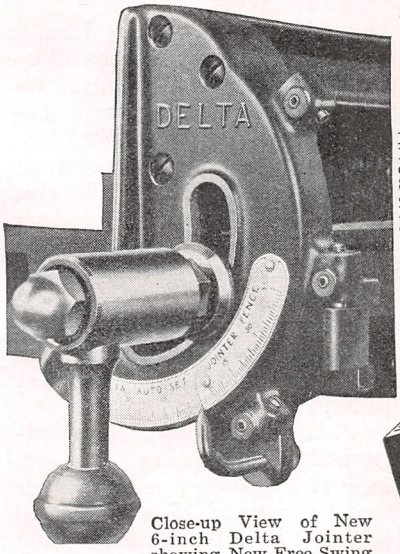
of New "Delta" 6-in. Jointer

1. New Patented Delta fence with 3 Automatic Stop Positions;
2. Full 6-inch Capacity;
3. New Free Swing Dual Control Handle;
4. Cuts up to ½-inch deep rabbet;
5. Long Hollow-cast Tables;
6. Special Dove-Tailed Ways on which Tables ride.

And many other unusual features and improvements.

NEW TOOLS—NEW IMPROVEMENTS IN 1935 "DELTA" LINE

The new 6-inch Delta Jointer is but one of the many new improvements and tools announced this year by Delta engineers. This year the Delta line of motor-driven woodworking tools is more complete than ever before. Delta standards of efficiency, quality, and convenience have been strictly maintained—and Delta prices still kept at their low levels. Good compact motor-driven tools are within the reach of all. Every woodworker will find the new 1935 Delta line of unusual interest.



Close-up View of New 6-inch Delta Jointer showing New Free Swing Dual Control Handle—but one of the many special features of this unusual Tool. Note 3 Automatic Stops for setting fence quickly in most-used positions.

MAIL COUPON FOR 1935 "DELTA" Catalog

It is crowded with photographs and information about the new line of 1935 Delta tools. It shows how Delta tools are built to stand the grind of production work, and yet are so low priced as to be within the reach of all. So your name will be placed on the mailing list to receive the 1935 Delta catalog without delay. Enclose only 10 cents at same time for Book of Practical Delta Projects, 32 pages of new and novel things to make with over 100 blue prints, working drawings, photographs and illustrations—and complete directions.

NEW BOOK for WOODWORKERS

32 page book "Practical Delta Projects"—crowded with new and "out of the ordinary" things to make—with over 100 photographs, working drawings, and easy-to-understand illustrations. Simple, complete instructions make every project easy to follow. Every woodworker should have this book. Send 10c with coupon. 1935 Delta catalog mailed postpaid.

DELTA MANUFACTURING COMPANY
3775 N. Holton St., Milwaukee, Wis. Dept. A1134

DELTA MANUFACTURING CO., Dept. A1134
3775 N. Holton St., MILWAUKEE, WISCONSIN

I enclose 10c (stamps or coin), for which please send me one copy of "Practical Delta Projects." Also place me on your mailing list to receive 1935 Delta catalog of quality motor-driven woodworking tools.

☐ Check here if you own Delta tools now.

Name..... Age?.....

Address .....

City..... State.....

POWER TO COME BY RADIO

(Continued from page 699)

No transmitter of the type ordinarily used in radio is necessary. The station on the surface would need only a power amplifier impressing voice energy upon a loop placed directly above the mine. To receive the signals below the surface of the ground the miners would need an amplifier to which a loop is connected at the input and a set of headphones at the output. Using audible frequencies, the signals penetrate the upper strata of the earth's surface with the metal in the ground actually helping conduct them instead of absorbing them.

Electric generators could be used in the mine for communicating back to the surface, but if the generators were electrically powered, there is a possibility the power supply would stop if an explosion or cave-in broke the wires. So I suggest the use of hand-driven generators for the purpose.

All this cable development opens up an amazing new field of radio-electrical technique which will enter into our homes to make our future lives more carefree. It is my belief that the application of the vacuum-tube oscillator to super-power transmission cables may change our whole understanding of the uses of such radiant energy for purposes involving the use of heat, light and power.

Cables can be laid along or under highways. These can furnish power to automobiles, trucks and street cars. They can also furnish heat and light to mobile units passing along the highways. And units powered in such a way would need no gears to be shifted. Variable condensers and inductors would time the motor units.

In our homes we can carry the same idea further. A coil underneath the ironing board powered by the cables along the highway in front of your house can heat your iron. From the same source you could heat your house, do your cooking and operate other appliances. These same cables running along the street also may bring you entertainment and news in the future by carrier current telephony.

And it is quite possible your future gardens will be grown by radio, that the arid deserts can be made fertile by radio, that the growth of animals can be stimulated tremendously by radio. A solar generator

(Continued to page 136A)

QUEER FISH

(Continued from page 716)

three to four feet in length, and weighing from forty to sixty pounds each, can make short work of a small oyster reef. When young, they are striped like a zebra. Later they become a dusty color. A large female will lay 6,000,000 eggs.

One of the most interesting fishes of the Gulf is the sawfish which possesses a strong flat blade protruding from its head. Sharp, pointed teeth are embedded on both sides of the blade. It is a common custom for fishermen to cut off the saw-like blade for a souvenir.

Among the strange members of the shark family is the hammerhead, which has its eyes on the side of its T-shaped head. This head is really a curious flattened expansion from its body. The thrasher shark is another odd fish. With the upper lobe of its tail as long as the rest of its body, it swims swiftly into a school of small fish, slashing and whipping its tail violently. Within a few minutes scores of fish become dazed. Then the thrasher wheels about, opens its mouth and swallows its prey.

HOW TO BUILD AN AMPLIFIER RACK

(Continued from page 741)

of this description can be used for housing homemade receivers.

Ordinary angle iron, ⅛ by 1 by 1 in., is employed. For the large floor rack illustrated, four 5-ft. lengths are required for the uprights. The top and bottom angle-iron frames are built exactly alike. The construction is shown clearly in the photos and Figs. 1, 2 and 3. Four 26-in. lengths and four pieces 14¾ in. long are used for the frames. These pieces are drilled for ¼ by ¾-in. stove bolts, as indicated. Both frames are now assembled, with a single bolt at each corner, as shown in the photo at lower right. The wood baseboard and bottom strips are bolted to the lower frame with long stove bolts.

Sheet steel, in a perforated cane pattern, is fastened to the sides and top with machine screws. The shelves may be made of sheet iron or plywood 15 in. wide and 25¾ in. long. The front panel construction is optional; for this rack, two 26½ by 30-in. heavy-gauge sheets of satin-finished eraydo were used.

"NO DEAR, YOU CAN'T GET BY WITHOUT SHAVING"

"You can't get by without shaving." Your wife—your girl—your associates may not tell you this. But that's what they probably *think* when your face is marred by stubble. For bristles are repulsive to everyone, men and women alike. So how can any man afford to risk the good opinion of others by failing to shave often and well!

Today shaving is not a task. The Gillette "Blue Blade" positively guarantees ease and comfort—even if your skin is tender. In fact—this blade is especially made for men with tender faces—and permits twice-daily shaving, when necessary, without irritation.

The Gillette "Blue Blade" is sharp—amazingly sharp—the smoothest-shaving blade that can be produced. See how its perfectly finished edges—automatically ground, honed and stropped—skim through your beard. Enjoy the benefit of blade-making equipment not equaled anywhere—and inspection methods that eliminate any blade with the slightest flaw.

And when you unwrap your first Gillette "Blue Blade" notice how it is "anchored" in the envelope so the edges reach you undamaged—just as they left the factory. Try this blade on our money-back guarantee of satisfaction. Ask your dealer for Gillette "Blue Blades."

GILLETTE BLUE BLADES

NOW 5 *for* 25¢ · 10 *for* 49¢

BOYS! Learn to Play Billiards AT HOME!

A Genuine Brunswick Completely Equipped Pocket Table $5.50
42½"x22½"

Cushion Covered Gully Table $7.95
Slightly higher in West and Southwest

Boy! What fun you'll have with the gang all there, playing on this genuine Brunswick Pocket Billiard Table! And your Dad—he'll want to get into the game, too. For this Brunswick Junior Playmate is a scientifically scaled replica of Brunswick's famous regulation tables—the kind your Dad plays on in YMCA's and commercial billiard rooms. It teaches you to have the same keen eye and cool, steady nerve that the big tables develop. Junior Playmates come fully equipped in sizes for all ages at very modest prices. See them on display at your favorite store!

FREE! Send for Big 56-Page Book of FREE LESSONS by World's Best Billiard Players

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Ideal TRAILER HITCH
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MOST PRACTICAL HITCHES MADE!
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LOOK, MEN and BOYS!
Have You Seen Them?

GENUINE LEATHER TIES; can't be told from silk. Fancy patterns; durable, won't wrinkle. **SELL ON SIGHT;** big profits, repeat orders. Be independent, have your own business. **$5 TO $10 A DAY EASILY.** Extra bonus for live wires. Send 50c or stamps for sample and kit. Information free.

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Has a RIFLED barrel

Crosman SILENT .22 Rifle

NO CLEANING
LOW COST AMMUNITION
ADJUSTABLE POWER
PEEP SIGHTS

Grooves inside barrel make the Crosman a real rifle with all the hair-splitting accuracy this term implies. Shoots bullet same size as .22 powder rifle, but silently, powerfully, with no recoil, using the terrific force of compressed air—same force U. S. Navy uses to drive 2000 lb. torpedoes. Marvelous for target, small game. Single and 20 shot repeater models. No license required.

FREE booklet containing important target and game shooting facts. Also free Crosman Catalog—or ask your dealer.

Crosman Arms Co., 413 St. Paul St., Rochester, N. Y.

LOW-COST POWER UNIT FOR CATHODE-RAY TUBE

(Continued from page 744)

The metal chassis is 8½ by 12 by 2⅜ in. high; all variable controls must be well insulated and the operator should avoid touching the metal chassis when the power supply is on. Note in Fig. 3 that the power-transformer secondaries are connected in series. If necessary to increase the output voltage, shift the lower X connection to upper X. With all connections made, except to input, turn the variable controls half way on before switching on the line supply. If your cathode-ray tube requires 2½ volts, turn the filament rheostat full on; if lower filament voltage is specified, check at tube socket with a voltmeter.

A clear spot on the tube should be obtained by adjusting the focusing control, if not, reverse the primary connections on one of the power transformers. Now adjust the sweep control so that the beam traces a horizontal line about 2 in. long, as shown in the insert photo at upper left.

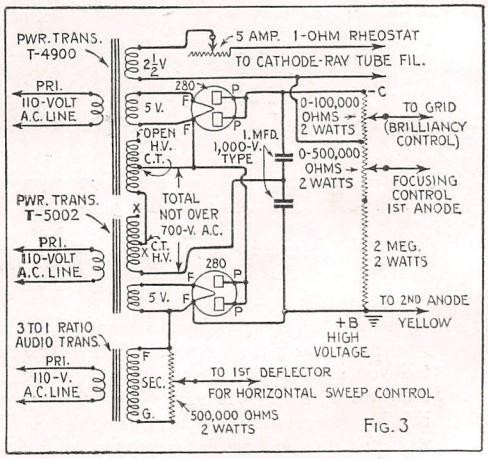
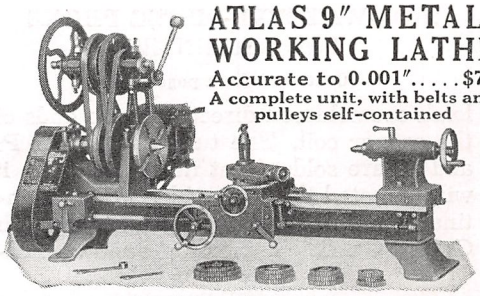


FIG. 3

The fuzziness noted at the ends of this line are due to a defective a.c. supply obtained from a d.c. to a.c. converter; your line should be clean cut. Brilliancy is controlled by the grid potentiometer. The photo at lower right shows some of the varying lines traced by organ music obtained by clipping the input leads across the voice coil of a receiver. In addition to checking distortion in amplifiers, the oscilloscope may be used to check amateur transmitters, vacuum tubes, condensers and inductances.



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Accurate to 0.001″..... $79

A complete unit, with belts and pulleys self-contained

It's ready to run, this 9″ Atlas Lathe. Self-contained countershaft, all belts **included** in the price. Set a motor on the bracket, plug into a light socket and it's ready to go. No outside shafting to place. No extras to buy.

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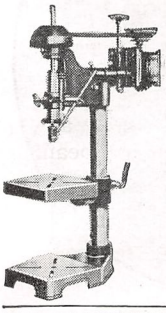
18″ bed (also larger sizes up to 36″) of heavily ribbed cast iron machined and ground on precision equipment. IMMEDIATE SHIPMENT for 2 weeks' trial with guarantee of money back if not satisfied. Write for Easy Terms and free illustrated catalog of the ATLAS FULLY EQUIPPED LATHE. Real metal-working Lathes as low as $40. Write for information.



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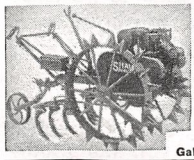
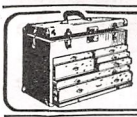


Hurry! Low prices still in effect but can't be guaranteed! Amazing money-maker for farms, truck gardens, nurseries, etc. Plows, discs, seeds, cultivates, mows, rakes, hauls; runs belt driven machines. Gear shift models, 1 to 5 H. P. Costs 3c per hour to run. Write for FREE CATALOG and 10 DAY TRIAL OFFER. Also SPECIAL OFFER to AGENTS. Address nearest office.

SHAW MFG. CO., Dept. 4511
Galesburg, Kansas Columbus, O.



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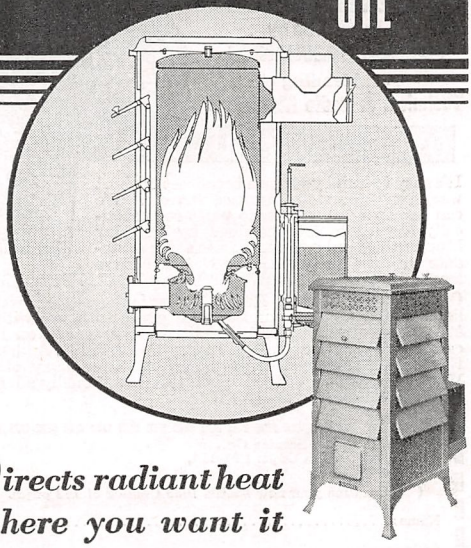
NEW HEAT-DIRECTOR

gives greater comfort **BURNS OIL**



Directs radiant heat where you want it

Heat-Director No. 1007. Listed by the Fire Underwriters. Diagram shows vaporizing burner and patented heat projectors.

Here's clean stove-heating! If you are tired tending ashes, investigate the new Superfex oil-burning heating stoves.

The Superfex Heat-Director has patented shutter-like heat projectors which may be opened to direct radiant heat at any desired angle.

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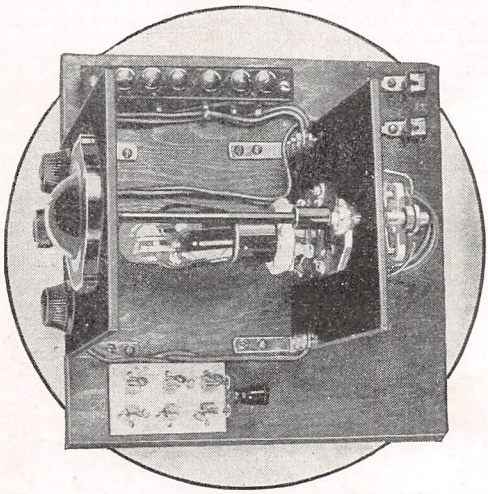
TWO-WAY FIVE-METER PHONE FOR BEGINNERS

(Continued from page 743)

leads are soldered directly on the ends of the copper coil. The tube-plate leads P_1 and P_2 are soldered at the same point; it will be noted that the grid-coil leads continue on out to the grid socket terminals G_1 and G_2. The common ground connection is made on a soldering lug placed under the socket-mounting bushing at the rear of the panel.



Two porcelain stand-off insulators, for the antenna feeders and coupling coil, Fig. 5, are mounted as shown. The coupling coil is the same diameter as the other coils and may be made of ordinary insulated hook-up wire sufficiently stiff to be self-supporting. This coil is placed about ¼ in. from the copper coil. The change-over switch and all other connections are clearly shown in Fig. 4 and the various photos.

The parts cost, including tube, batteries, hand microphone and head phones, about $13.00. A complete material list may be obtained upon application without charge. The 5-meter antenna used is optional; the Pickard variety described in the May issue, or the Johnson "Q" type, illustrated in Figs. 6 and 7, are both suitable low-cost ready-made units. An enlarged blueprint of the layout and wiring diagrams is available, those who wish it should specify blueprint No. 203. The antenna is suspended as high as possible and the feeders may be separated with 2-in. strips of bakelite or transposed as shown in Fig. 7.

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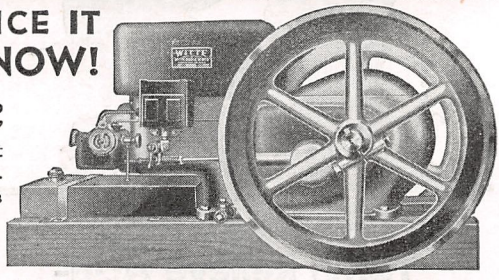

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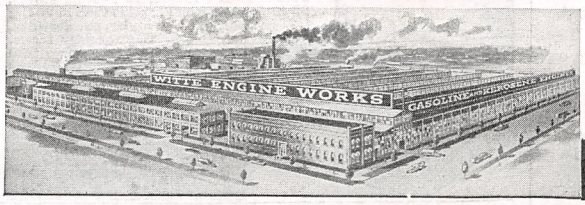

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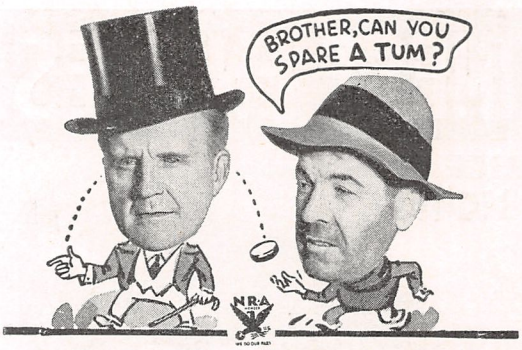

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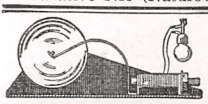

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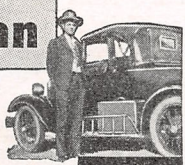

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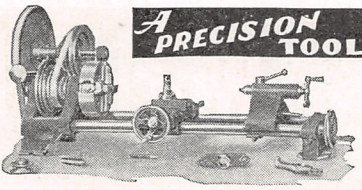

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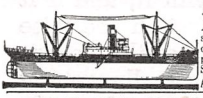

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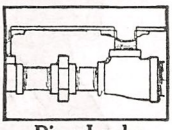

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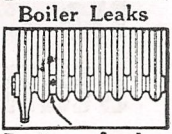

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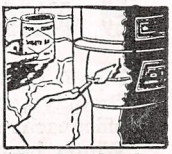

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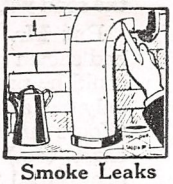

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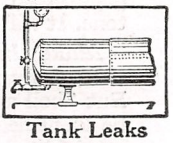

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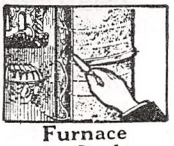

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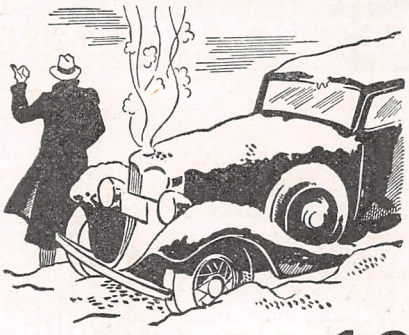


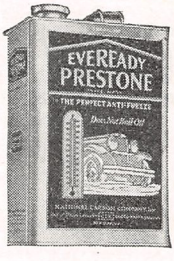
He counted 19 stalled cars in 9 miles of driving

Mr. J. Edward Lynch, 1195 Union St., Brooklyn, N. Y., drives 9 miles to his office each morning. And on Nov. 15th last Winter he counted 19 cars stalled along the road with "freeze-up" troubles.

But Mr. Lynch's garage service-man had shown him how inexpensively his car could be protected *all Winter long* with only one shot of concentrated anti-freeze. (Yours can show you the same protection-chart, too.) The only anti-freeze that is guaranteed to do this is Eveready Prestone. It will not boil off.

Make the Nose Test: Eveready Prestone, truly non-evaporating, is odorless. But "boil-away" anti-freezes can always be identified by the odor. Regardless of special "treatments," they will evaporate when the engine runs at high speeds.

Mr. Lynch rode all last Winter safely protected by Eveready Prestone. He's using it this year, too...And saving himself a lot of worry and expense.



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EVEREADY PRESTONE

TRADE MARK

IT'S ALL ANTI-FREEZE...no water

SERVICING THE NEW CARS

(Continued from page 731)

cars running true. All this has been complicated by the introduction of independently sprung front wheels. Camber is adjusted on knee-action wheels by removing shims while the caster angle usually is adjusted through loosening the nuts that hold the control arms to the upper and lower knuckle support yokes and by then turning the upper support bolt. It is work calling for accuracy, and in knee-action jobs this accuracy must be combined with other considerations, such as seeing that there are no passengers aboard during the test, that (if coil springs are used) the two front springs are expanded to within one-sixty-fourth inch and that the front tires are properly inflated and equal in wear. To check the accuracy of such changes the latest equipment obviously is desirable. One tool used for this purpose is combined with a turning plate to check king pin inclination as well.

Have you ever considered having tire resiliency checked? This is done by means of a bulge gauge. Tires must have the same resiliency if the car is to ride comfortably and safely. Accuracy in tire pressures will not control resiliency, and any effort to do so may result in having one tire softer than another. Checking with a bulge gauge often results in discovering the cause of unbalanced conditions with the shimmy, wheel tramp and other difficulties which they create.

The mechanic who used to spin the hand crank to test compression now uses a pair of gauges which reveal the amount of compressed air admitted to a cylinder being tested and the ability of the cylinder to hold it. The point of leakage at valves or pistons is definitely located under the newer method by using a stethoscope.

If the new car doesn't run properly there is some efficient device somewhere to prove what is wrong with it; and if it seems to be giving satisfaction the wise motorist will avail himself of the opportunity to make sure he is really getting his money's worth. Detroit aimed merely to provide a new era in cars but succeeded in starting the ball rolling toward a new era in service.

Guesswork is being taken out of service. That means putting dollars back into the car owner's pocket.

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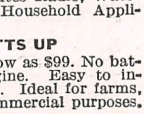

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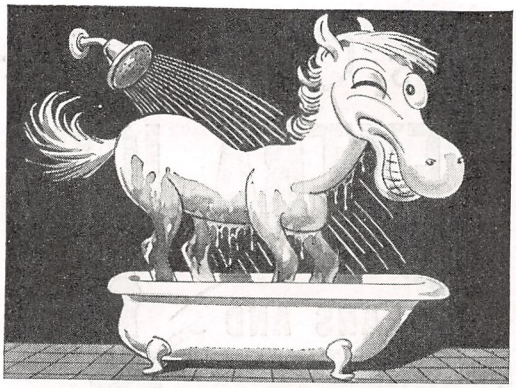

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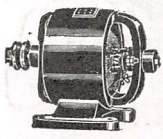

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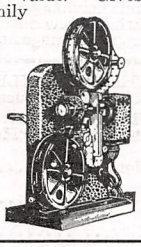

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THE WORLD'S LARGEST EYE

(Continued from page 678)

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Mounting also is another factor which may preclude a larger telescope. For this telescope a monumental base must be built and machinery surpassing any ever constructed must be built for revolving it with the stars. The skeletonized framework which supports the fifty-five-foot barrel as it projects heavenward weighs several tons. An elevator will be used to gain the top of this barrel. Across it the distance will be twenty-four feet. Cost also is another deterrent factor in the construction of a larger telescope. The cost of this one, including equipment, will run in the neighborhood of $6,000,000.

To take the place of such equipment it has been suggested that "electronic telescopes" be built. These telescopes would step up faint starlight, not by mirrors, but by an electric apparatus. Photo-electric cells would pick up the faint starlight from a silver-coated plate and convert it into electric energy. After being amplified in electronic tubes this starlight would be reconverted into light. Passing through the electric tube would be equivalent to stepping up the starlight as much as could be effected with a 2,000-inch mirror. Scientists predict that some day such a telescope will be built.

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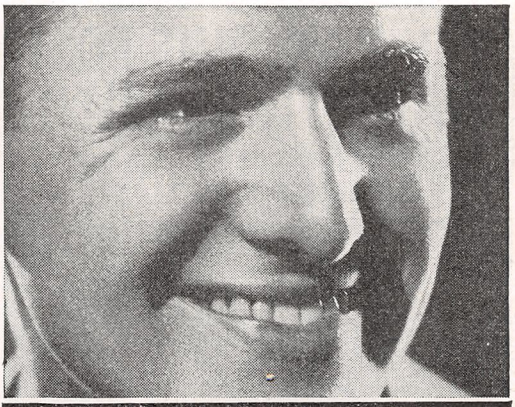

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. . . because he made his ideas COUNT!

PERHAPS Jim was no brighter than other young fellows about the office. But he had one good practice. When he had an idea for improving office routine or increasing sales, he typed it out neatly on his Remington Portable and sent it into the head office. Those neat memos of Jim's were read, they attracted the boss's attention. When a vacancy occurred, it was natural to give Jim the promotion.

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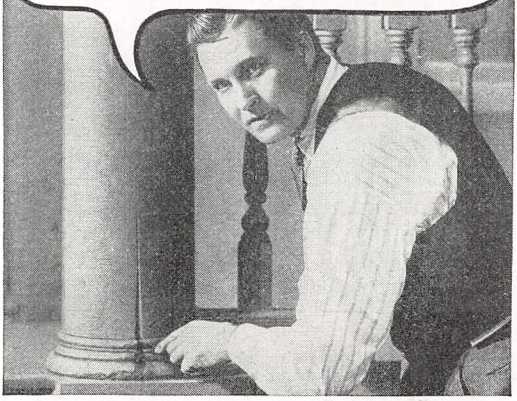

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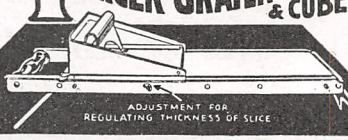

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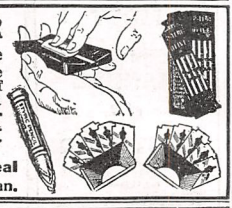

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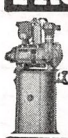

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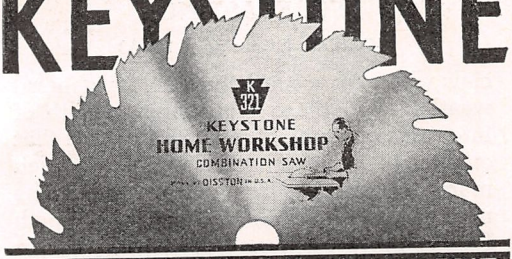

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CRYSTAL-CLEAR • 100% LUBRICATING
PREVENTS RUST

NEW TRICKS OF WEATHER FORECASTING

(Continued from page 116A)

cials who look toward the west for general weather trends are receiving a wealth of information from ships on the Pacific that enables them to visualize conditions much more accurately than in the past. The movement of cold air masses in the north Pacific plays such an important part in making continental weather that the meteorologists think that ultimately research on the coasts of the Orient will be used to supplement the ship reports.

Another way that weather is anticipated is by "backtracking" each change to its source. When a storm occurs the weather officials study the day-by-day weather maps of the previous week. This type of research recently resulted in the discovery that the heavy summer rains that occur in Arizona really originate in the Gulf of Mexico, instead of in Sonora as had been supposed. Now, when a storm moves westward across the Gulf and inland over Mexico the weather bureau can anticipate rain in Arizona nearly a week before the storm reaches that state.

Aside from its general forecasts, the weather bureau expects that its special services will also be made more accurate by the present campaign. These services include warnings of storms to marine shipping, flood warnings, and warnings to pilots of conditions likely to form ice on airplanes. A recently added service is that of foretelling "forest-fire weather," based on a study of winds, humidity, combustion temperature, and the inflammability of materials. At the same time that meteorologists are making forecasts two days in the future they are working toward reliable predictions for as far as four or five days ahead. They foresee such a need when dirigibles will be making long over-water flights on regular schedules.

Comparatively little is known yet about clouds, although clouds have been used in forecasting for centuries. Since clouds result from conditions in the air quite accurate forecasting is possible by observing them, but the trouble is that they are often misinterpreted. When the study of clouds is complete, weather officials say, there will be many more classifications than at present and more accurate "snapshot" forecasting will be possible.

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CLEANS AUTOS NEW WAY!

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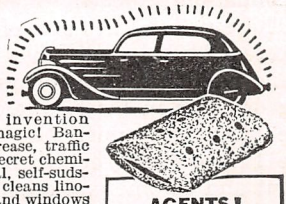

Revolutionary invention cleans autos like magic! Banishes dust, dirt, grease, traffic film—thanks to secret chemical and sensational, self-sudsing feature. Also cleans linoleum, woodwork and windows without work! Auto owners and housewives wild about this strange chemical sponge! **SAMPLE OFFER!** Samples sent at our risk to first person in each locality who writes. No obligation. Be first—*send your name today!*

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COMPARE the outstanding features of this Remington Bolt Action Rifle, Model 33, with any other .22 rifle on the market today. Then if you agree with the hosts of present owners that it's the greatest gun value ever offered, it's yours for

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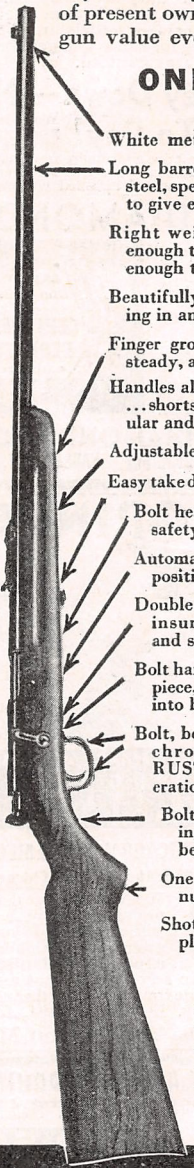

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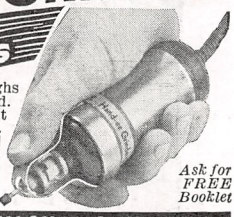

Weighs one pound. Plug in any light socket and do 1001 jobs. Do away with slow hand work. Remove burrs, take out nicks, sharpen tools, etc. Grind where files won't reach. For shop, home or tool kit. (Model A.) A. C. or D. C. operation, 110v., 13,000 r. p. m. Order on 5 day trial . . satisfaction guaranteed.

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ARMOR SAVES GRIDIRON STARS

(Continued from page 652)

in order to make sure that it did not impair his vision too much.

Ordinary equipment protects six danger spots. The adjustable pads in the pants cover the knees and thighs. The hip pads take care of both hips and kidneys. The shoulder pads protect all of the shoulders including the collar bones. The headgear protects the upper part of the head.

The biggest stars, who usually are unbothered by frequent injuries, prepare their equipment chiefly in the matter of fit and efficiency. They may add a bit of padding here or trim some from there; they may insert an elastic strip in one place or cut a slit elsewhere. Eventually many of these little details become a part of standard equipment.

A football star can't afford to take unnecessary chances.

POWER TO COME BY RADIO

(Continued from page 120A)

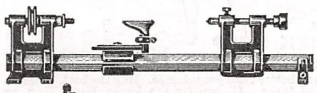
could furnish power for a vacuum-tube oscillator. High in the air a metal-covered balloon could be held by a copper-plated steel wire. The sun could furnish the power which would be turned into radio power, shot up to the balloon which would, I believe, in turn precipitate rain. That could for all time end such things as droughts and it could also eliminate the great waste areas now covered with blistering sun and sand.

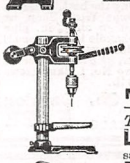
Enormously high-frequency radio power could be used to dehydrate fruit and vegetables. And the power, in addition to extracting all moisture so fruit and vegetables could be kept almost forever without losing their health-giving qualities, would also kill disease germs in the fruit or vegetables. Great hydroelectric projects could transmit radio frequency for reclamation projects.

These possibilities are, of course, in the future. Already we have train and airplane communication by radio, the guiding of ships in harbors, aids to the deaf, the blind, the miner, the surgeon. Only the future years of laboratory development and commercial adaptation of these developments can prove to the world just how powerful and far reaching are their uses to humanity.

"AMERICAN JUNIOR" POWER TOOLS

$2.50 EACH





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MASSIVE GREY IRON CASTINGS AND STEEL—workable, sturdy, unconditionally *GUARANTEED* to do the work intended.

LATHE 6 in. swing, 12 in. c. to c., extra lengths 50c per ft.; centers 35c extra; other accessories include, chucks, saw-table, face-plates, etc., a complete shop in itself.

DRILL PRESS 16½ in. high, 6½ in. swing, distance chuck to base 7 in., takes 9-32 in. drills; chucks 50c, swinging table 35c.

BENCH SAW adjustable for depth cut, takes 5 in. blades; rip-gauge furnished. 4 in. blade 50c, 5 in., 75c.

SABRE SAW does all scroll and band saw work better and faster, blades 15c.

DISC SANDER with table tilting 45 degrees up or down, used for finishing, jointing, grinding, buffing, etc., most useful all round finishing machine.

SPINDLE SHAPER takes 1 in. x 5-16 in. cutters, does all molding.

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Cash Daily Making Do-Nuts!

Greaseless!

Big Profits in Your Own Business at Home

HERE'S a steady, fine-paying business that earns big profits—you get two to three times your production cost. You get cash every day. Start right in your own home, in spare time, or have a shop of your own. Men and women in many parts of the country earning good steady incomes—making a product that everybody likes, that sells on sight—delicious, greaseless do-nuts, baked by electricity with the Ringer Electric Do-Nut Baker.

"Your machine has made a 'New Deal' for us," reports H. E. Burns, West Va. "I am getting on my feet again, thanks to your Do-Nuts. They sell themselves. Am working my machine 8 to 10 hours a day so you see business is good."

Year 'Round Business

—Steady demand from stores, cafes, homes—and a fast seller at Fairs, Parks, Beaches, Highway Stands, Rinks, etc.

S. W. Pitts, Kentucky, writes, "Have tried out several different kinds of do-nuts. Am well pleased. They take like hot cakes. Have a chance to get contracts beyond our capacity with one baker alone, and am contemplating purchasing another soon."

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POSITIVELY NO INVESTMENT

I do not want a cent of your money nor or ever. I have nothing to sell you. There are no deliveries to make—no house to house canvassing to do—no collections—nothing for you to buy. To sincere men I send, absolutely free, complete plans and outfit costing me over $15,000 to produce. This is a unique, compact encyclopedia—a marvelous, efficient, self-demonstrating unit that brings cash into your pocket the first hour. Complete details sent free and without obligation. Better write me now—this offer might not appear again. Send name.

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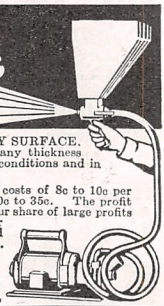

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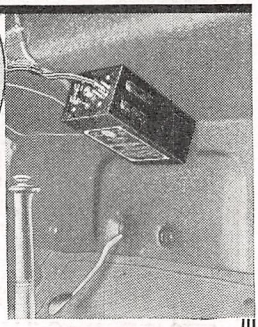

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No excuse now to have a dead battery . . latest KRW Auto-Charger for ALL CARS keeps battery up in any kind of weather. Gives all the "juice" needed for positive starting, operating auto radio, hot water heater, defroster and other electrical devices. Light weight, 7 lbs. Only 7" x 4¼" x 3". Easy to install, drill one hole in underdash. The KRW Auto-Charger goes where you go, works while your car is idle . . simply plug into nearest light socket. Operates on 25 to 60 cycles, using only 50 watts. Can't overcharge because charging rate tapers automatically when battery reaches full capacity. No liquids, bulbs or moving parts. Has two charging rates—2 and 5 amps. Fuse guards against current flow-back if power circuit fails. Unconditionally guaranteed for one year. Ask any Ford Dealer who we are (Est. 1916). *Circular on request.* AGENTS WANTED *everywhere.*

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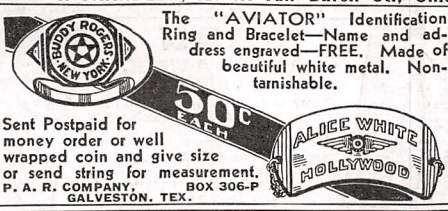

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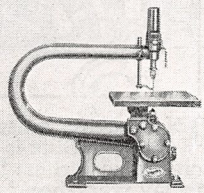
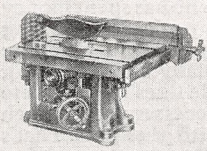
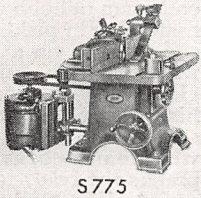


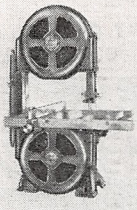
J 505
14" Jig Saw



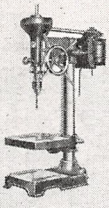
B 735
8" Bench Saw



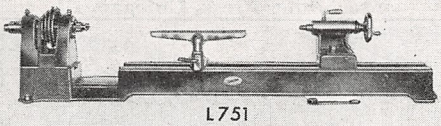
S 775
Shaper



BN 725
12" Band Saw



D 920
Drill Press



L 751
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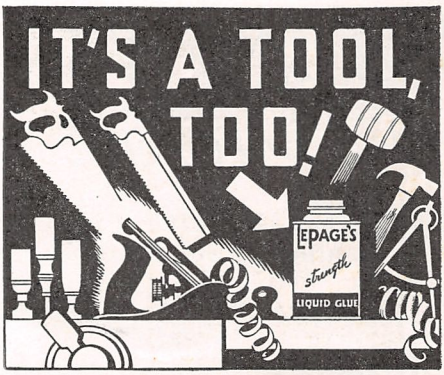

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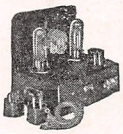

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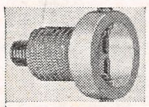

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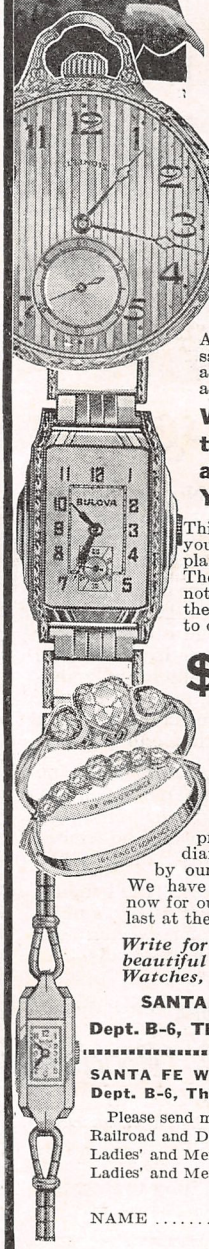

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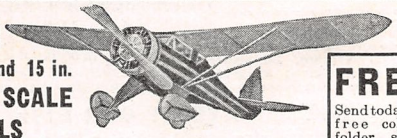

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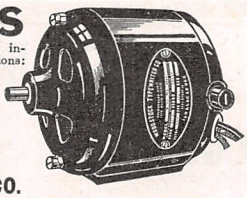

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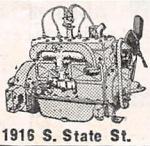

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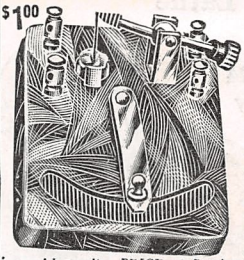

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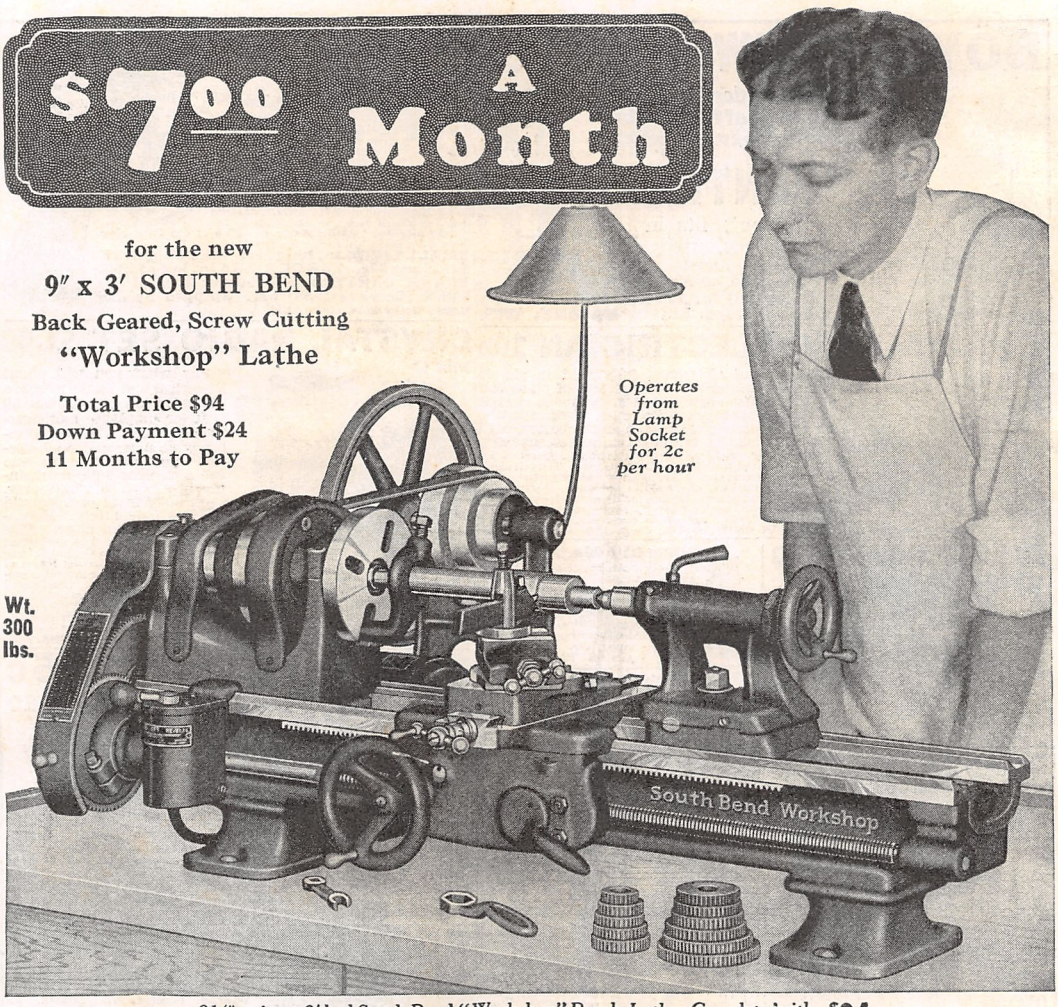

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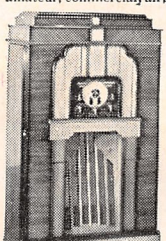

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